

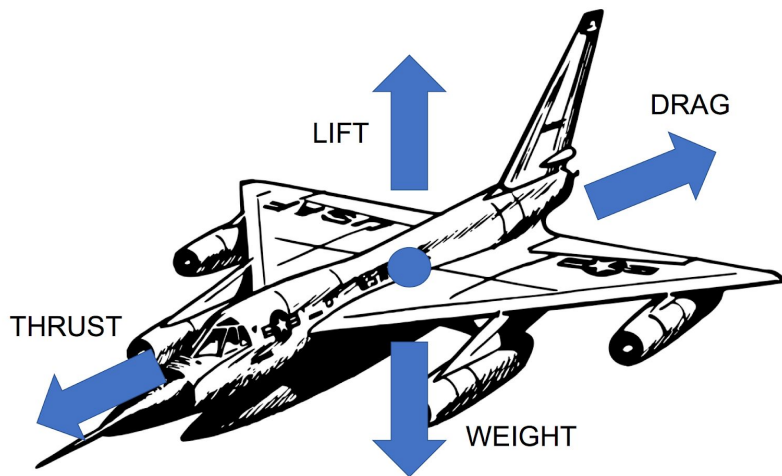
Flight Structures	Grade 6 – Flight
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Lesson Plan	Safety Notes	Never throw an object towards someone else.
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Description
 Can you create a paper aircraft using 1 sheet of uncut paper? How far will it glide? Explore what allows flight to be possible, and apply learning about what elements affect the distance and direction of your glide.

- Materials**
- Paper (8.5x11” office paper is fine – you can recycle scrap paper!)

Science Background
 Some structures may seem simple, but a number of design elements go into making that structure stable and able to withstand external forces (e.g., gravity, wind) and internal forces (compression, tension, shear, and torsion). Flight structures are unique in that they need to be strong, stable and also lightweight. We often say that in Flight, we can group the forces into four. We have the WEIGHT of the aircraft pulling downwards, so we need to create LIFT to go in the opposite direction. We need a forward force that we call THRUST and the force of the air against the forward motion, we call DRAG.



Some of the elements that add strength and stability include: material choices, support pieces, the overall weight of the structure and how that weight is distributed (i.e., where is the centre of gravity? Does symmetry matter in your design?), the weight of the load that the structure must support, and where the force of that load will be applied to your structure. For example, it would be easy to say an aircraft wasn't strong enough if the wings ripped off under the stress from the wind.

Design engineering follows a series of steps, known as the Engineering Design Process. These steps are important for planning, building and improving a successful structure.

1. Ask - Identify and research a need
2. Imagine - Develop possible solutions
3. Plan - Design a prototype
4. Create - Build and test your design
5. Improve - Make changes to your design and retest it

Activity Procedure

- The goal is to design an aircraft using 1 sheet of uncut paper that will glide as far as possible. Take some time to think about a piece of paper and what different shapes you might be able to achieve that would actually glide.
- The design phase is an important step to the engineering process that should not be skipped. Take time to think about your design and how you would like to build it. Will the body be longer than the wings? How will you reduce drag during flight?
- Fold your glider using only 1 sheet of paper. This will be your prototype.
- Don't forget to test your structure. When you throw your plane, what happens? You can make adjustments and try again. And again, and again! Try folding your wings and tail differently to see how your glide path changes. Try throwing at a different strength or angle. You can also try holding it at different points before you toss it. Does it fly better if you toss from near the nose or the tail?
- After you have made adjustments to your structure based on how well it flies, choose which way you think that it flew best. Fold a fresh sheet with your final design, be sure to make crisp folds. If you fold the same plane with different paper, how does your flight path change?

Debrief

Building paper aircraft can be a great way to experiment with the forces of flight. It allows us to make quick modifications and retest often. Folding and adding layers can change the weight distribution. Throwing at a different angle can cause different lift and drag. There are so many things to be able to change and try.

The Engineering Design Process often involves repeating steps, redesigning, re-testing, and improving based on learning from where designs fail or can be improved. It's important to understand that design failure isn't bad unless you use a faulty design as a final product. With each new design try, your plane might be able to go further.