Western Engineering Outreach

Flight

Grade 6-8

Meet Today's ENG HERO!

Craig Miller - Assistant Professor (CEE) and Program Coordinator (Boundary Layer Wind Tunnel Lab)

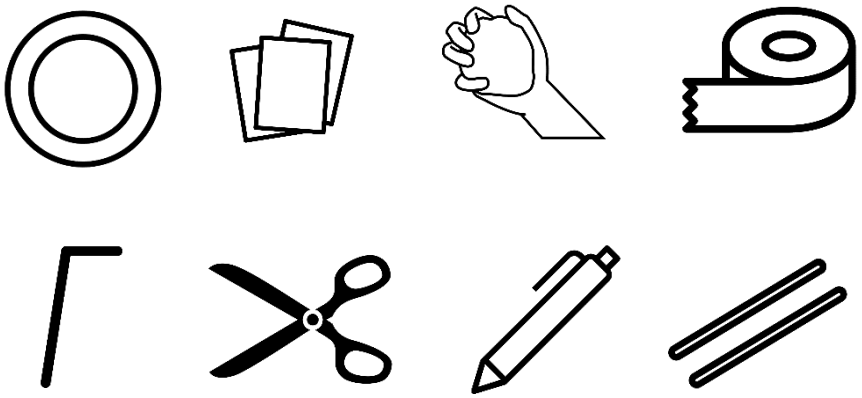
Dr. Craig Miller received his B.E. and M.E, both in Mechanical Engineering, from the University of Auckland, New Zealand, before receiving a Ph.D in Engineering Science from the University of Western Ontario in 1996. Between 1988 and 1990 he was employed as a Research Assistant by what is now the Department of Naval Architecture and Marine Engineering at the University of Strathclyde in Glasgow, Scotland. He also worked as a Research Fellow at the Building Research Establishment in England. During his time there he was primarily responsible for the development of surface wind field models for the modelling of risk due to both tropical and extra-tropical cyclones. To learn more about Dr. Miller visit: https://www.eng.uwo.ca/civil/faculty/miller_c/index.html

Learning Goal:

- Students will learn about the forces related to flight.
- Students will be introduced to the Engineering Design Process as they design, build and test a glider.
- Curriculum Connections: Grade 6 - Flight. Grade 8 - Fluids.

Materials Needed:

- Paper
- Styrofoam plates
- Pen
- Scissors
- Masking Tape
- Straws
- Clay / Hot glue stick.
- Wooden dowel
- Cardboard



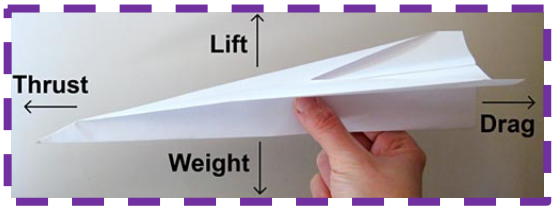
Engineering and Science Connections:

Today, we will learn about Aerospace Engineering, planes and the forces related to flight.

What is Aerospace Engineering?

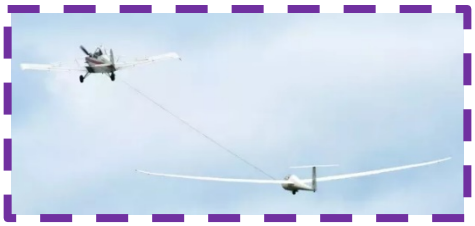
- Aerospace Engineering Involves designing, building, testing, and controlling machines that fly.
- Aerospace engineers typically work in two main areas: Aeronautical and Astronautical Engineering
- Aeronautical engineers work on machines that fly inside Earth's atmosphere, including airplanes, jets, helicopters, etc.
- Astronautical engineering involves the design and development of machines that travel into outer space, beyond the Earth's atmosphere. These spacecrafts travel to other planets or stars.

What are the forces that act on paper airplanes?



- A force is something that pushes or pulls on something else. When you throw a paper plane in the air, you are giving the plane a push to move forward. That push is a type of force called thrust.
- While the plane is flying forward, air is moving over and under the wings and is providing a force called lift.
- If the paper plane has enough thrust and the wings are properly designed, the plane will continue to fly for a good distance.
- As a paper plane moves through the air, the air pushes against the plane, slowing it down. This force is called drag.
- The weight of the paper plane affects its flight and brings it to a landing. Weight is the force of Earth's gravity acting on the paper plane.

What are the forces that act on gliders?



- Gliders are a type of aircraft that stays aloft without any power derived from an engine. (AKA a sailplane.)
- Instead of using an engine to generate lift, like a traditional plane, the glider attains velocity with the help of a separate support system.
- In the case of a hang glider, the person operating the glider usually runs along the side of a cliff or a hill. Larger hang gliders rely on a mechanical start such that it may be attached to a tow airplane, which drags it upward into the air. At a given point, the line connecting the two crafts is disconnected.

- Alternately, a car may serve as a towing device until the glider attains lift. Once a glider is airborne, it rides the air currents to maintain its velocity and navigate a smooth landing.

More about gliders/sailplanes:

- The construction of sailplanes is largely similar to that of standard airplanes. Typically, body materials include carbon composites, fiberglass or aluminum. Some sailplanes, however, also have components made of wood or fabric stretched over steel tubes.
- Hang gliders also use special fabric, like a sail or wing, stretched over a steel frame.
- Toy gliders use the same principle as large-scale gliders and are typically made of balsa wood or a similar strong, stiff and lightweight material.
- Sailplanes tend to have a wingspan between 40ft and 90ft.
- While an airplane's flight time is only limited by its supply of fuel, a glider's flight duration and trajectory depends entirely on the behavior of air currents.
- Typically, a sailplane starting at an altitude of 3,000 feet can remain aloft for 20 to 25 minutes.

Video Recommendation: *World Record Flugtag Flight*

https://www.youtube.com/watch?v=KUlZQ3JyrBM

Activity:

Challenge 1: Paper Plane

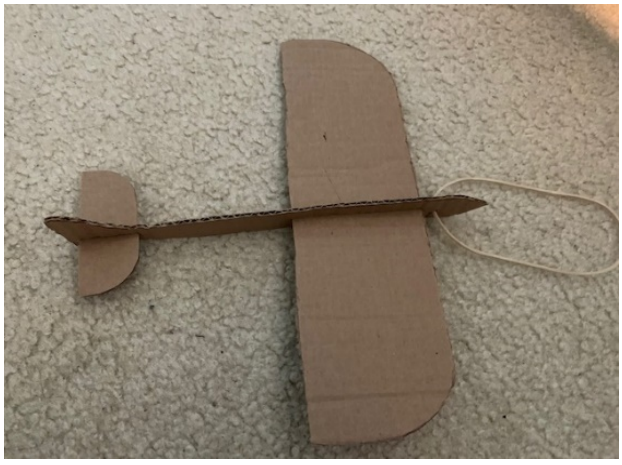
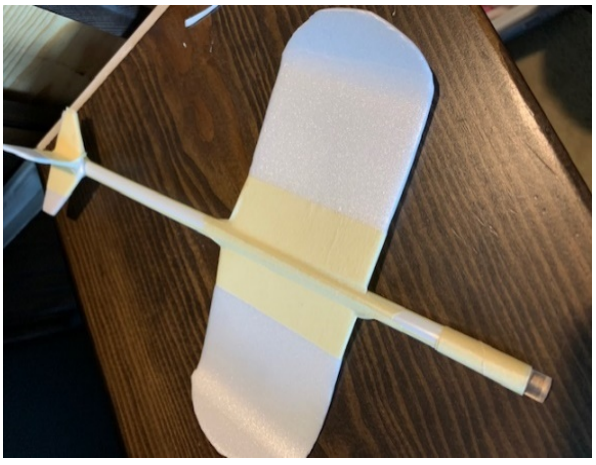
- Thinking about the forces of flight, create a paper plane that can maintain flight for at least 10 feet. Think of ways to modify the folding of the paper to maximize distance covered.
- When creating drag on your plane, how does that affect the distance achieved.
- Tip: to create drag, cut flats on the tail of the paper plane, folds the flaps back to create a bend in the paper so that the flaps are now pointed towards the ceiling

Sample Examples:


Challenge 2: Glider

- Grab a sheet of paper and brainstorm how you are going to create your glider out of the materials provided.
- Tip: To create curve within the wings, roll the foam over a wooden dowel. The curvature of the wings will affect the amount of drag the glider experiences. However, too much curve = too much drag and flight will be minimal!
- From a high-level, throw your glider and time it to see how long it stays off ground.

Sample Examples:

What Did You Learn?

- What is drag and how does it affect airplane flight?
- How do you think you could change the amount of drag a paper glider has?
- What provides thrust to a real airplane?
- How does the wing shape affect the distance travelled?

Future Learning

- Turn this activity into something more advanced and fun. Let's make a larger glider!
- Using items around the house, try to design and build a larger scale glider and fly it outside your house. Maybe grab a stuffed animal to be a passenger and fly in it!

Share your creations!

We would love to see what you made. Email as at discover@uwo.ca or tag us on social media.

Instagram: @westernueng
Twitter: @westernueng
Facebook: @westernueng

Thanks for discovering with us!