

FOUR FORCES OF FLIGHT

DESCRIPTION OF SESSION

This session helps Explorers understand the four forces of flight.

CATEGORY

- Team Building
- Higher-order Thinking

OBJECTIVES

By the end of this session, participants will be able to:

- Create representations of the four forces of flight.
- Understand how these four forces allow an aircraft to fly.
- Discuss how changing one of the four forces affects the others and the aircraft itself.

SUPPLIES

(Double amount of supplies if you choose not to do rotations.)

- An electric floor or desk fan
- Computer paper—one ream
- A bag of pennies (approximately 30–50)
- Four 2- or 3-ounce paper cups
- Four rubber bands
- Four 2.5- to 3-inch squares of fabric

ADVISOR NOTE: Text in italics should be read aloud to participants. As you engage your post in activities each week, please include comments, discussions, and feedback to the group relating to **Character, Leadership, and Ethics**. These are important attributes that make a difference in the success of youth in the workplace and in life.

ACTIVITY

Four Forces

Begin by defining each of the four forces of flight. Say:

- **Weight** is the force of gravity that pulls objects toward the center of the Earth.
- **Lift** is the force that acts in opposition to weight. Wings generate most of the lift for aircraft.
- **Thrust** is the force that propels an object. Engines produce thrust for aircraft.
- **Drag** is the force that acts in opposition to thrust. Friction and differences in air pressure create drag.

Then have participants assist you in demonstrating each of the forces.

For lift, have a participant hold one end of a piece of paper in front of the fan. Turn on the fan and watch as the paper lifts into the air.

For weight, place four paper cups on a table. Fill three of the cups with varying amounts of pennies, leaving one empty. Cover the tops of the cups with a piece of fabric and place a rubber band around the fabric to hold it in place. Begin by having participants close their eyes and try to organize the cups from lightest to heaviest. Then have them drop the first two cups at the same time from the same

height. The heavier cup should hit the table first. Then have them drop the second and third cups and make observations again. Repeat with the third and fourth cups. If they organized their cups correctly, the fourth cup should be the first to hit the table because it contains the most weight.

For thrust, have each Explorer wad up a piece of paper into a ball. Instruct the Explorers to hold one arm out in front of them and drop the ball of paper. Then ask the Explorers to start with their hand next to their shoulder and push their arm forward to release the ball. Then finally ask the Explorers to put their hand behind them (as if to throw a baseball) and throw the ball. Have the Explorers make observations.

For drag, say: *Remember the days when the thought of your parents leaving you to go somewhere was the worst thing imaginable? Many of you probably tried the leg trick. You probably thought that if you could just grab their leg and hold them down, they wouldn't be able to move, let alone leave. Do you remember what happened next? Grab a partner and test it out!* The Explorers should be able to move but at a much slower pace because they are being pulled back by their partner.

If you have time, have the Explorers make paper airplanes and discuss the four forces of flight as they apply to the paper airplanes.

ADVISOR NOTES

You may want to divide the Explorers into small groups or pairs. Rotations may be a good use of your time as well so you do not need as many supplies.

You may also choose to define the four forces after Explorers have completed each station to allow participants to discover each force on their own.

ADVISOR NOTE

Some sample questions are below. They are designed to help the participants apply what they have learned to their own interests. You are welcome to use these questions or develop your own questions that relate to your post or specific focus area.

REFLECTION

Focusing Questions

- *What did you learn during this activity?*

Analysis Questions

- *Now that you know how each force affects flight individually, how do you think they work together to make an airplane fly and maneuver?*
- *If the weight of an airplane is greater than its lift, what will happen? What can you do to change this situation? Describe a situation where a pilot may be faced with this dilemma.*

Generalization Questions

- *Why is force significant in the field of aviation?*

RESOURCES

None