Flight

Lesson Plan

Season 2, Episode 1: (0:00–13:05)
bit.ly/steamcamp-s2-ep1

Learn how the U.S. Air Force F-16 Fighting Falcon Thunderbird jets fly so fast and then use science inquiry to investigate flight with paper airplanes!

Nevada Academic Content Standards/Next Generation Science Standards:

K-PS2-1 Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.

K-PS2-2 Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.

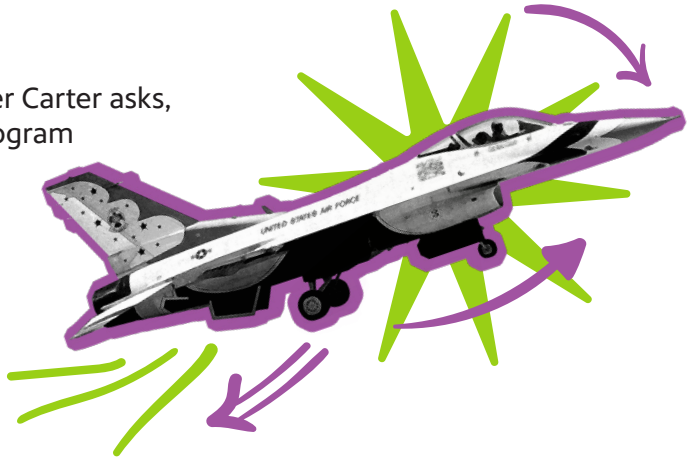
3-PS2-1 Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

3-PS2-2 Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.

5-PS1-1 Support an argument that the gravitational force exerted by Earth on objects is directed down.

Engage:

Share the beginning of the program with students. After Carter asks, "How does a Thunderbird jet fly so fast?," pause the program and ask your students the same question. Write this essential question down and record student responses to reveal students' current knowledge, connections to the topic, and further questions they have.



Materials

- Multiple sheets of paper of varying weights and sizes, such as:
  - Standard copy paper
  - Construction paper
  - Brown paper bags
- Paperclips
- Measuring tape (you could even use a non-standard measurement, such as your foot length. Just be sure to walk heel-to-toe in a straight line)
- Data collection chart
- Optional: ruler to help fold crisp lines

Explain:

Introduce the words: aerodynamic, thrust, air resistance, drag, lift.

- Have students guess their meaning and record their ideas.
- Ask students to listen for the words as they watch the video clip, featuring members of the U.S. Air Force Thunderbirds team.
- When they hear one of the words, encourage students to make a gesture, such as wiggling their fingers.

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Explain, continued:

Pause the video at key spots to ask questions that strengthen comprehension and help children make connections.

- After TSgt DiMaggio describes key parts of the F-16 Fighting Falcon, review:
  - Why is the nose of the plane pointed? (to make the jet aerodynamic and reduce drag, so it can fly faster)
  - What do the wings do? (produce lift)
  - What does the engine do? (thrusts the jet forward)
  - How does the jet produce smoke? (by releasing a little bit of oil near the exhaust)
- After Maj Brewer speaks, review how close, fast, and high Thunderbird jets fly. (18 inches to 3 feet apart; 450 mph; up to 40,000 feet)
- After the Aircrew Flight Equipment team describes the gear, review G-forces. What is a G-force and why do Thunderbird pilots need special equipment? (G-forces multiply the force of gravity on the pilot's body; to provide oxygen and keep their body safe)
- After SSgt Jackson describes the cockpit, review how the equipment is like what you would find in a car. (the throttle is like the gas pedal of the car and the side stick is like the steering wheel)
- Watch the "What did we learn?" segment to reinforce the concepts

Reflect on the new knowledge students have acquired.

- Revisit the essential question and have children answer it by incorporating the vocabulary words; ask children to share any new information they acquired or additional questions they have.
- Review the four jobs highlighted in the video: pilot, quality assurance inspector, aircrew flight equipment technician, and avionic system technician. Is one job more important to the Thunderbird team than another? Why or why not?

Explore:

Use the at-home activity segment to guide students through the scientific inquiry process:

Observe and notice: Share the video segment in which Jessica outlines directions for folding a paper airplane and conducting the investigation. Pause the video before Carter tests her airplanes and have students predict how far her paper planes will fly.

Ask questions: What changes could Carter make to her paper plane design to make it fly farther?

Plan and predict: Have students gather materials needed to make their planes. How will they vary the design of their four planes? Remind them to make only one small change to the original design with each plane! Maybe use heavier or lighter paper, bend a wing, fold some flaps up and down on the back, add a paperclip, change the way they throw, or make a very tiny version of it! Predict how each plane will fly before tossing.

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Explore, continued:

Investigate/collect data: Have students conduct the experiment and use the Paper Plane Data Collection Chart to keep track their design changes, observations, and flight distances.

Draw conclusions/share ideas: Analyze the information on the data collection chart and look for patterns.

- Which airplane flew the farthest? Why?
- Did the kind of paper matter? Did the way they threw it make a difference?
- Do bigger or smaller planes fly farther?
- What happened when they added the weight of the paperclips or bent a wing?

Help students make connections between anything they learned in the video and the outcomes of this activity, such as aerodynamics, drag, lift, thrust. What new questions do students have?

Extend:

View the book talk with Joanna, a local Young People's Librarian. If possible, check out the books Joanna shared with students:

- **Spinning Blimp: Beginning-Level Paper Airplanes** by Marie Buckingham
- **Needle Nose! Advanced-Level Paper Airplanes** by Marie Buckingham
- **Space Bomber! Expert-Level Paper Airplanes** by Marie Buckingham
- **Airplanes: Soaring! Turning! Diving!** By Patricia Hubbell

Encourage students to continue exploring measurement, proportion, and scale by accessing the following PBS KIDS resources:

- **Zoom: Glider Boy:** bit.ly/zoom-gliderboy
- **Flight: Science Trek:** bit.ly/flightsciencetrek
- **Ready Jet Go!:** bit.ly/readyjetgo-gravity

Share:

Visit vegaspbs.org/steamcamp to upload photos or videos of student projects, or share them with us on social media by tagging **@vegaspbs**.

Keep in mind, if you are submitting a video, make sure we can see what students are doing and hear what they are saying! Also, please keep videos to one minute or less.