National Aeronautics and Space Administration

STEM LEARNING:

Explore Flight: Wind Tunnels Student Guide (6-8)

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EXPLORE FLIGHT: WIND TUNNELS (6-8)

PART 1: WHAT ARE WIND TUNNELS

Part of the process of designing NASA's newest aircraft, the X-59 QueSST, was testing models of the aircraft in NASA's wind tunnels.

In this activity, you will explore what wind tunnels are and what they are used for, and then design your own airplane model and test it in a small wind tunnel.

Investigative Question: What are wind tunnels and what are they used for?

Personal knowledge: With your group, think about what you know about wind tunnels. If you don't know what a wind tunnel is, imagine what you think it is. Write down some thoughts below

Watch the video on your own or with the class: https://youtu.be/MksHQpIzui4

Use what you saw in the video and/or other resources provided by your teacher or online to find out more about wind tunnels. Write down some notes below.

PART 2: WIND TUNNEL ENGINEERING DESIGN CHALLENGE

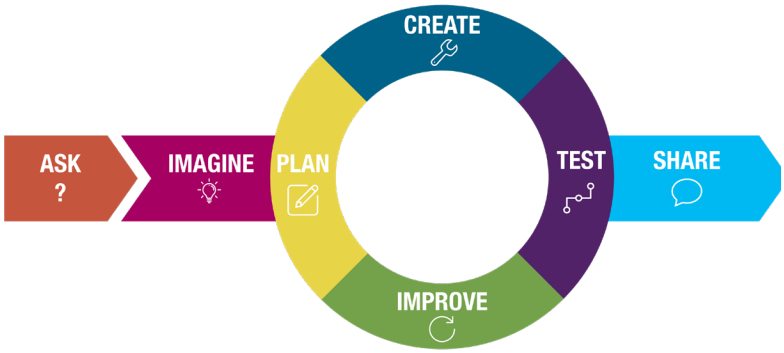
YOUR GOAL
Build the most Aerodynamic Airplane model from the materials provided.

CRITERIA
Travel the shortest distance (centimeters) in the wind tunnel.

CONSTRAINTS
1. You must use all of the materials provided.
2. No extra materials can be used.
3. Wingspan of the model cannot be wider than the tunnel.

Ask
What questions do you have about this engineering design challenge?

Imagine
As a team, brainstorm what you already know about airplanes, and what makes a vehicle aerodynamic (have less drag). Write down some thoughts below.



Plan

Make a quick sketch of at least two possible designs below. If you have more ideas, sketch them on a separate piece(s) of paper.

QUICK SKETCH 1

QUICK SKETCH 2

As a group, examine all fo the possible designs. Discuss the pros and cons of each. Decide on the initial design and mark it with a star (*).

Why did your team choose this design?

Create

Build your first aircraft design. Make a detailed drawing in the space below and be sure to label all of the materials.

INITIAL MODEL DRAWING

TEST 1

Take your design to the wind tunnel and test it. Place your model inside the tunnel on the start line, with the nose pointing towards the fan and touching the start line. Place the fan on the fan line. Run the fan for 10 seconds and repeat three times. Record your results below.

	Distance Moved (cm)	**Observations**
Test #1		
Test #2		
Test #3		
Average Distance (cm)		

IMPROVE

What did you learn during testing that will help you design the next version of the aircraft?

If there is time, make improvements to your plane in preparation for the final test. Use a colored pen or marker to make notes on your Initial Design Drawing showing what you changed.

FINAL TEST

Each group will present their final design to the class, then test it in the wind tunnel. Record your final results.

	Distance Moved (cm)	Observations
Final Test		

SHARE

In preparation for the final class discussion, answer these questions with your team:

What worked well with your design?

What would you improve if you had more time?

What were the design features of the class models that moved the least in the wind tunnel?

Class Discussion: Be prepared to share what you learned from testing with the class. During the discussion, write down any new ideas about how to improve your aircraft design in the space below.

EVALUATION

Claim

Your claim is a technical drawing that provides your team's best possible solution to the design challenge.

- Prepare a final diagram of your proposed design in the space below or on a separate piece of paper. Label the materials you used. Also, include and label the four forces of flight and how they interact with your design.

EVIDENCE

Evidence includes analyzed, scientific data selected from test results and discussions with other engineers that supports the claim (why you think this is the best design).

- Use data and observations from your team's wind tunnel tests and other teams' test results to support your design.

REASONING

Reasoning is used to connect the data/observations (evidence) you choose to support your design to your claim (proposed design).

- How your proposed design is based on science (four forces of flight).
- The strengths and weaknesses of your proposed design

GO FURTHER

Do some research on other objects that can be tested in a wind tunnel, or learn more about the history of wind tunnels. Here are a few videos links to get you started:

Trucks: https://youtu.be/ubyxYHFv2qw

Soccer balls: https://youtu.be/9p2w5Zg52uo

Cars and the history of wind tunnel testing: https://youtu.be/1QiS97_qYU4

See more about X-59's wind tunnel tests:
https://www.nasa.gov/feature/langley/x-59-quesst-model-flies-the-simulated-skies-at-nasa-langley-wind-tunnel-testing-session

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