HEADS IN, HEARTS IN

Paper Airplane Race

Instructions for Set-Up

Supplies

- ❑ "Guide for Families" handout
- ❑ Clear plastic standup display (optional)
- ❑ "Engineering Process" handout (1 per participant or family)
- ❑ Paper, 8.5 inch by 11 inch (6–7 sheets per participant or family)
- ❑ Masking tape or painter's tape
- ❑ Ruler, yardstick or measuring tape
- ❑ Display table

Activity Preparation

- Purchase or locate items on supply list.
- Print one copy of the "Guide for Families" handout. Laminate or place in a clear plastic standup display to allow participants to see it more readily.
- Print one "Engineering Process" handout per participant or family. Optionally, print and laminate a few to leave on the table.
- Designate a testing area approximately 25 feet long. Mark a starting line on the floor with masking tape or painter's tape. Using the ruler, yardstick or measuring tape, measure a few distances from the starting line and mark with the tape (1 foot, 3 feet, 5 feet and so on). Safety suggestion: Have a wall as a backdrop to the testing area to stop planes from flying.

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Guide for Families

Learning Objectives

What you need to know:

Engineering is a process used to solve problems by designing, building and testing things. An engineer is a person who uses math and science to create new things, solve problems or make things better.

Aerodynamics is the way air moves around things. When an airplane is flying, aerodynamics is an important factor in keeping a plane in the air. When an airplane is flying, several forces act on a plane including gravity and thrust. **Gravity** is the force that pushes things down toward the earth, as when you throw a ball up into the air and it falls back to the ground. **Thrust** is force that pushes forward. Examples of thrust include the force of an engine on an airplane or the act of throwing a paper airplane forward.

Engineers design airplanes, cars and other machines to move quickly and efficiently taking into consideration aerodynamics, gravity and thrust.

What you will do and learn:

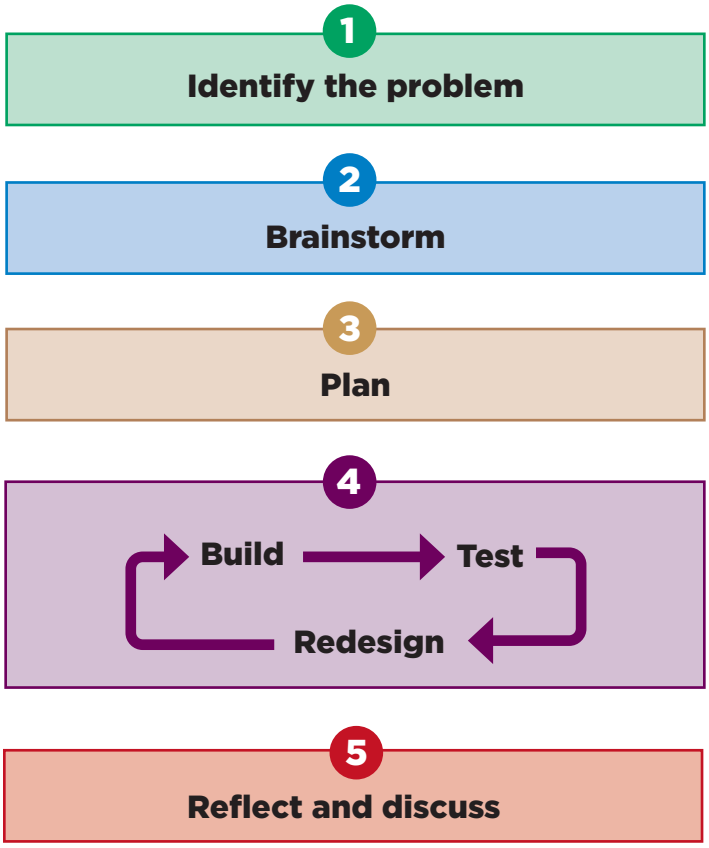
In this activity, you will make a paper airplane. The goal of this activity is to design your airplane to see if you can make one that goes the farthest. You will also explore the role that aerodynamics, thrust and gravity can play in how far it will fly.

Instructions

1. Using the "Engineering Process" handout, start to work through building your paper airplane.
2. Identify the problem: How can you design and build a paper airplane that flies the farthest?
3. Brainstorm: What do you need to know to build a paper airplane? What makes a paper airplane move forward? What makes it fall to the ground? Does how hard you throw a paper airplane influence how far it goes?
4. Think: How can you build your airplane? Think of several different designs for paper airplanes. Do you think a long skinny one will fly further than a wide-winged one?
5. Plan: Gather your materials. Choose which design(s) you think will allow a plane to fly the farthest.
6. Build: Build your airplane.
7. Test: Stand at the starting tape line and throw your airplane. Measure how far it flew using the ruler, yardstick or measuring tape. Throw your airplane a few more times and measure how far it flies. Try to use the same amount of force (thrust) every time you throw the airplane to test. Consider the plane's aerodynamics, or the way that the air moves around it.
8. Redesign: Make some changes to your design to try to increase the distance your airplane will fly. Try some of the ideas you came up with during your brainstorming.
9. Repeat steps 7 and 8 as many times as needed.
10. Reflect and Discuss: How did you find the solution to this problem? What materials could you use instead of the materials provided today? How would it have been different with different materials? What kind of designs do real airplanes have? How are real airplanes similar or different from paper airplanes? Have you ever seen an airplane that looks like your paper airplane?

Engineering Process Handout

Engineering Process



1. **Identify the problem:** Engineering is about identifying problems and designing solutions. As you go through these activities, think of the goal you are trying to achieve.
2. **Brainstorm:** What are the many different ways I could solve this problem? What are the potential advantages and disadvantages of different ideas? What things do I need to think about to make that solution successful?
3. **Plan:** What are the different ways I can solve this problem or make the build? What steps can I take to try out my solution? What do I need to do to prepare my build? What might happen if I choose that solution? During your design phase, you might discover new problems that you need to brainstorm.
4. **Build:** Construct and carry out the design. As you build your design, you might come up with more problems that you need to brainstorm and design new ideas for.

   Test: How does my solution work? Does it solve the problem? Is it effective? Are there additional problems?

   Redesign: How can I improve my design? What can I try to make my solution work better?
5. **Reflect and Discuss:** How did the solution turn out? What could I do differently next time? How would my design be different if I had different materials?