



HOW DO HOVERCRAFTS WORK?

Courtesy of: Engineers and Geoscientists British Columbia – Vancouver Branch

Introduction to Engineering (10-15 minutes)

Bring the group into a circle. Introduce yourself and what you study or do for work. Give time for the girls to ask questions or make comments. Ask some questions to find out what they know about engineering (below are some starting points). Try not to answer the questions now, just encourage discussion. The wrap up will answer these questions and they will get a chance to explore them during the activity.

1. Do you know any engineers?
2. What do you think engineers do?
3. Can you think about some different types of engineers?
4. What would an engineer do when they go to work for the day (or night)?
5. Can you think of what an engineer might have worked on in your city?
6. Who does an engineer look like?
7. Can you describe what an engineer wears?
8. What tools does an engineer use?
9. Where would an engineer work?
10. What does an engineer study in school?

Learn about the different disciplines of engineers by reading a description of the type of work they do. You do not have to do them all, just choose a few. Use the print-out on the next page to help them with the different names. For younger girls (8 and under), you can have them vote as a group on which answer they think is right and for older girls (9 and up), you can ask for them to raise their hand to guess.





Types of Engineers

| Description | Discipline |
|-------------|---------------|
| | Aerospace |
| | Agricultural |
| | Biomedical |
| | Chemical |
| | Civil |
| | Computer |
| | Electrical |
| | Environmental |
| | Geological |
| | Industrial |
| | Mechanical |
| | Structural |



Hovercraft Aerodynamics (10-15 minutes)

Hovercrafts are used today for many reasons. The Coast Guard uses them to perform rescues; the military uses them for transporting equipment over challenging terrain; environmental companies use them to access sensitive ecosystems without causing a disturbance; they can also be used as transportation or for recreational purposes. Did you know there is even one at Vancouver International Airport? They can travel over grass, swamps, ice and snow, bodies of water, sand, and mud.

Hovercrafts work by creating a thin cushion of air under the large, flat bottom of the vehicle. Think of an air hockey table, except instead of the air coming up from the table, it comes down from the hovercraft. The air cushion reduces friction between the bottom of the hovercraft and the surface underneath. Think about rubbing your hands together (or try it!) and then think about how they are more slippery if you rub them together with soap. The soap reduces friction between your hands.

Side Note: Friction also creates heat, which is why rubbing your hands together in the winter warms them up.

One of the volunteers will demonstrate an air curtain with a ping pong ball and a straw. Since this is all it requires, it is something the girls can try at home.

1. Place the straw upright and hold or balance the ping pong ball on top.
2. Tilt your head up and start blowing through the straw.
3. Keep blowing until it lifts off the straw. The space between is an air cushion!

Side Note: For Girl Guides, Pathfinders, and Rangers, you can talk about forces and how the force from the air cushion pushing up is what counters the gravitational force of the hovercraft pushing down. When they are equal, the hovercraft hovers. When the force from the air cushion is greater, the hovercraft will rise until they are equal. When the gravitational force is greater, the hovercraft will descend until they are equal. The same goes for the ping pong ball.



Hovercraft Building (20-30 minutes)

Girls will break into groups of two (Girl Guides, Pathfinders, and Rangers) to three (Sparks and Brownies) and each group will receive the supplies to make one hovercraft together.

1. Cut a ring of plastic. The outside should be larger (3-5 cm) than the disc and the inside should be slightly smaller (1-2 cm) than the disc. A template is provided for those who need it.
2. Tape the ring of plastic to the underside of the disc to create a curtain to help trap the air. Try to make this as smooth as possible.
3. Securely hot glue (recommended) and/or tape the pencil grip standing up on end over the hole in the disc. There should be no gaps for the air to leak out between where the pencil grip and the disc meet.
4. Stretch out the balloon, so that it will be easier to blow up. Then, stretch the mouth of the balloon over the pencil grip.
5. Use a piece of straw to insert through the bottom of the disc and pencil grip and up into the balloon to blow up.
6. Once you are finished blowing up the balloon, pinch or twist the neck of the balloon to keep the air in while placing the hovercraft flat on the ground.

Hovercraft Testing (10-15 minutes)

Set up a start and finish line on a smooth flat surface. Wood, tile, laminate, etc. flooring or a large table are good options. Carpet will not work well. Line up all of the hovercrafts with balloons filled and pinched shut. Start the race with “Ready, Set, Go” and the girls let go of the pinched balloons and push the hovercrafts forward. The first one to the finish line wins. If none of the hovercrafts make it to the finish line, the one that went the farthest wins. Try the alternative options below to experiment with the hovercrafts.



| Alternatives | Instructions |
|-----------------|--|
| Size of Balloon | Inflate the balloon different amounts (small, medium and large) and see what happens to the hovercraft. |
| Amount of Force | Inflate the balloon and push the hovercraft with different amounts of force (a little, moderately and a lot). |
| Payload | Add a penny to the edge of the hovercraft and see if it will still hover. What happens if you add more than one? |
| Multiple | Find another group to partner with and tape your hovercrafts together. Fill up both balloons and let them go at the same time. |

Wrap-Up Discussion (10-15 minutes)

Come back together into a circle and talk about what the girls learned. Refer to the questions from the introduction, as well as the additional questions below.

1. Did your hovercraft work? Why or why not?
2. Do you think problems are always solved with the first solution you try?
3. Can you think of anything else you want to investigate about this problem?
4. What would you do differently if you tried this again (different curtain material, fins, different shape of balloon, etc.)?
5. What would you do the same?

The girls should spend 3-5 minutes at the end completing the evaluation form.

The girls are welcome to take the hovercrafts home (they just have to decide which one of them gets to).