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## Hovercraft Class Kit

AIR-520

### Your kit includes:

- ✓ 12 balloons
- ✓ 12 pre-drilled film canisters
- ✓ 12 CDs
- ✓ 1 strip of poster putty



### How does it work?

When the hovercraft is placed on a flat surface such as a table, air flows out of the balloon, down through the film canister, and under the CD. The CD is evenly weighted and has a very flat, smooth surface. As the balloon's air rushes out in all directions, it lifts the entire CD off the surface of the table. The layer of air between the table and the CD greatly reduces the friction (the force that resists movement between two objects) that would have existed if the hovercraft rested directly on the table. With less friction between the surfaces, the hovercraft glides easily across the table.

Furthermore, extra air molecules are packed underneath the structure which, in turn, increases the pressure under the hovercraft. This increased pressure below the craft produces an overall upward pressure force on the craft. Therefore, it supports its weight. Since air molecules are always leaking out from beneath the craft, you'll need a source of air molecules to replace them, which is provided by the balloon.

# NGSS Correlations

Our Hovercraft Class Kit and these lesson ideas will support your students' understanding of these Next Generation Science Standards (NGSS):

## Elementary

### 2-PS1-1

Students can use the Hovercraft to plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

### 3-PS2-2

Students can use the Hovercraft to 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

Students can use the Hovercraft to develop a model to describe that matter is made of particles too small to be seen.

### 5-PS1-3

Students can use the Hovercraft to make observations and measurements to identify materials based on their properties.

## Middle School

### MS-PS1-4

Students can use the Hovercraft to develop a model that predicts and describes changes in particle motion.

### MS-PS2-2

Students can use the Hovercraft to plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

## High School

### HS-PS2-1

Students can use the Hovercraft to investigate and analyze data to support the claim that Newton's Second Law of Motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

## Suggested Science Idea(s)

### 2-PS1-1 • 5-PS1-1 • 5-PS1-3 • MS-PS1-4 • MS-PS1-4 • HS-PS2-1

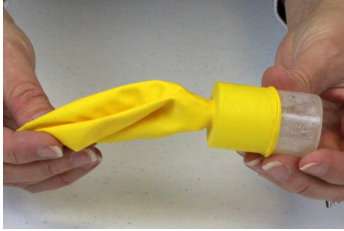
Students can use the Hovercraft Class Kit in a number of investigations on states of matter, air friction, and air pressure. Newton's Laws of Motion become tangible when using the Hovercraft. First Law (inertia, momentum, Second Law (force equals Mass time acceleration and Third Law (action-Reaction) can be demonstrated and investigated when using two or more of the Hovercraft. Adding variables in surface materials, weight to the Hovercraft and collisions allow students to explore.

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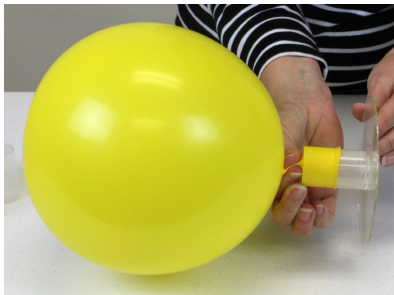
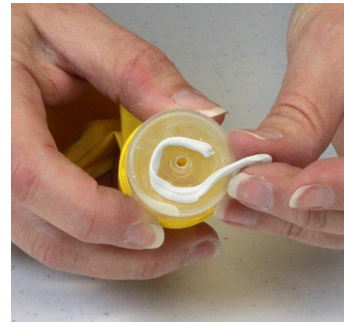
# Constructing Your Hovercraft

**To build your hovercraft, follow these simple steps:**



- 1.** Stretch the mouth of the balloon over the open end of the film canister. Be sure to pull the full neck of the balloon onto the film canister so the inflated balloon remains upright.

- 2.** Make a ring using a small amount of poster putty and place it around the hole on the CD. The ring should be the approximate diameter of the film canister's base. Experiment with the right amount of putty. Too much will add extra weight to your hovercraft; too little will not ensure a tight seal.



- 3.** Carefully set the balloon/film canister assembly on the ring of poster putty and press down firmly to seal.

- 4.** Inflate the balloon by blowing through the hole in the bottom of the CD and into the film canister.

- 5.** When the balloon is fully inflated, pinch the neck of the balloon or twist it to ensure that it doesn't deflate.

- 6.** Place the hovercraft on a smooth surface and let the air flow from the balloon. You may need to give the hovercraft a gentle tap to get it going.



# Additional Notes

## Helpful Hints:

- ✓ Place a piece of tape over the base of the hovercraft until you're ready to launch it.
- ✓ You may need to give the hovercraft a gentle tap to get it going.
- ✓ Experiment with inflating the balloon, twisting the neck to seal in the air, and then trying to fit the balloon neck over the film canister opening.

## Try this!

Use your hovercraft on a number of different surfaces to investigate where it works best. For example: a clean tile floor or a smooth counter vs. a carpeted floor or a piece of sandpaper.

Try altering the design of the hovercraft by changing some of the materials. For example, use an old vinyl record or foam meat tray (cut into a circular shape) as the base.

Create hovercrafts with different sized balloons.

Using a drill, make a larger hole in the bottom of the film canister, or using a pushpin, make more holes in the bottom of the canister. Does the hovercraft travel more smoothly? Is it more or less stable?

## Video demonstration

If you'd like to review the steps needed to assemble your hovercraft, please consult our video:



<https://www.youtube.com/watch?v=eQpRAb80k2E>

# Additional Notes

## A brief history

The hovercraft was invented in 1956 by Sir Christopher Cockerell, a British engineer. His idea was to build a vehicle that could move over the water's surface, floating on a layer of air. This would reduce friction between the water and vehicle.

Cockerell went on to build one of the most successful inventions of the 20<sup>th</sup> century. Today, hovercrafts are used commercially, by the military and for personal use.

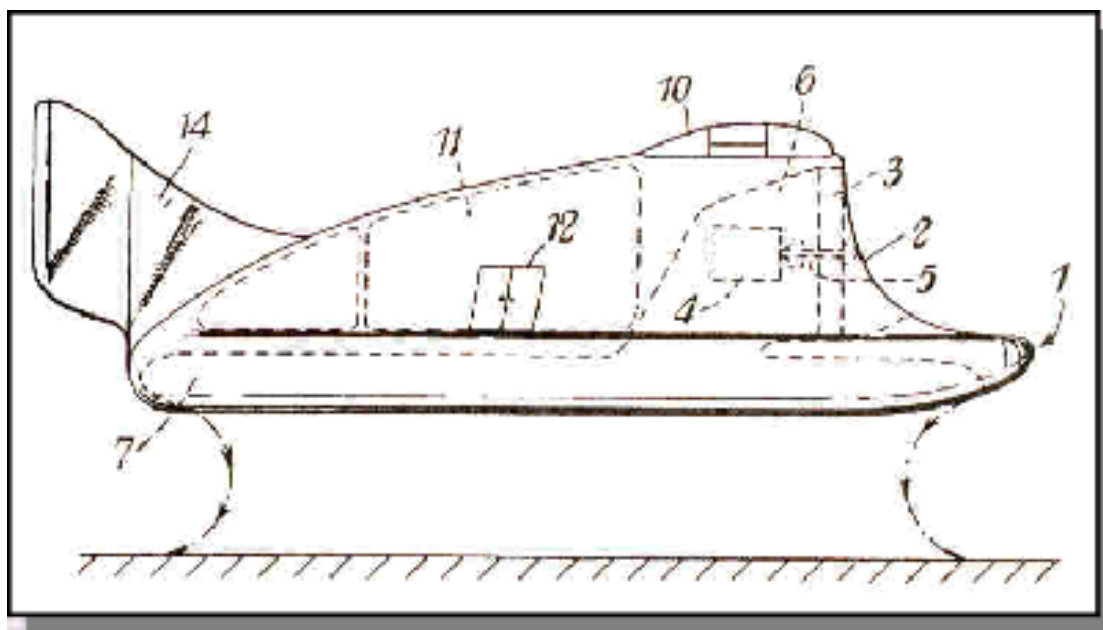


Image source: [www.design-technology.info/inventors/page11.htm](http://www.design-technology.info/inventors/page11.htm)

**Consider this:** Cockerell's hovercraft would not have been very successful if all it did was levitate above the water. All hovercrafts depend upon a propelling force to accelerate and travel from one point to another. Our [Hovercraft Additions—Collisions!](#) blog provides ample directions for a lab exploration in which students provide the propelling force, accelerate one levitating hovercraft into another, and observe the results.

Basically this extension activity explores the ideas of Newton's First Law (inertia, momentum), Newton's Second Law (force equals mass times acceleration), and even Newton's Third Law (action-reaction) using collisions between differently-weighted hovercraft.

<http://blog.teachersource.com/2013/06/06/hovercraft-addition-collisions>





# Take Your Lesson Further

As science teachers ourselves, we know how much effort goes into preparing lessons. For us, “*Teachers Serving Teachers*” isn’t just a slogan—it’s our promise to you!

Please visit our website  
for more lesson ideas:

[www.TeacherSource.com](http://www.TeacherSource.com)

Check our blog for classroom-tested  
teaching plans on dozens of topics:

<http://blog.TeacherSource.com>

To extend your lesson, consider these Educational Innovations products:



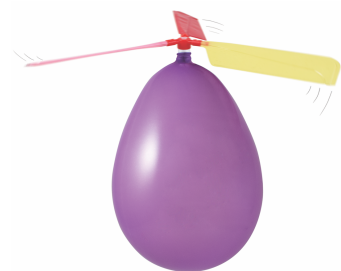
## **Bernoulli's Principle Class Kit** (AIR-500)

Is it Bernoulli's Principle or the Coandă Effect? Using high energy activities, your students will learn about air pressure and common but counter-intuitive phenomena. Our kit provides everything you need to demonstrate the relationship of air speed and air pressure for students in grades 4 to 8. The lessons can easily be adapted for

younger or older students. Materials for 25 students.

## **Air Pressure Bundle** (AIR-900)

Six air pressure demo goodies will certainly prove that science never sucks! Start with a Tornado Tube or Fountain Connection for hours of water play (and learning). Learn about lift with a balloon-powered helicopter. Your Harbottle is the perfect tool to demonstrate atmospheric pressure. How does that balloon stay inflated without being tied shut? The Pressure Pullers and Atmospheric Mat are guaranteed to baffle anyone who doesn't (yet) know about the pushing force of the air around us.



## **Balloon Helicopter** (AIR-610)

These balloon-powered helicopters are great for outdoor or indoor fun (if you have high ceilings). Simply snap the blades on the hub, place the balloon on the collar, inflate the balloon, and you're ready for lift off! When you release, air travels through the blades, causing them to spin. Lift is created and off it goes! We've gotten these to fly over 20 feet high. Blow up the balloon again to relaunch. Colors may vary.

