HOVERCRAFT

OBJECTIVE:

You will understand and demonstrate how a hovercraft minimizes drag, so reducing friction and allowing it to float across water.

INTRODUCTION:

Why are boats the shape they are? If they did not have a "sharp" end at the front, the effect of drag would bring them to a standstill. Drag is caused by friction between the boat and the water, and it slows down the boat. The more drag is reduced, the faster boats can move through water.

The effect of drag can never be removed completely, however. In the 1950s a British engineer named Christopher Cockerell (1910–) suggested an alternative solution to the problem. His idea was to build a vessel that would move over the water's surface, floating on a layer of air. In this way friction between the vessel's hull and the water would be reduced to almost nothing. He tested his theory by putting one tin can inside the other and blew air into them using a hair dryer. He found that the downward thrust produced was greater with the two cans, one inside the other, than with a single can.

In 1958, after much refinement, Cockerell's ideas were developed commercially. In 1959 the first hovercraft (the name given to Cockerell's invention) made its appearance. It was now possible to move across, rather than through, water.

TIME NEEDED:

1 hour

MATERIALS:

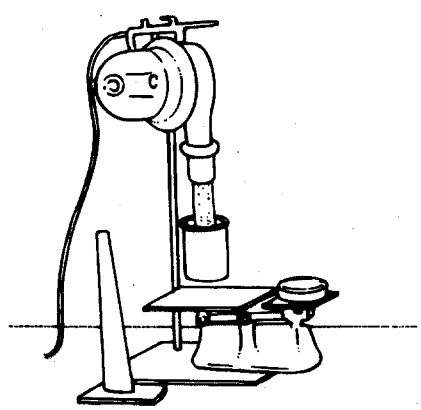
- 2 small styrofoam trays, of different sizes, but no larger than 8 1/2 in. x 5 1/2 in. (e.g., trays used for packaging meats in supermarkets)
- awl or cork borer
- cutting board
- ruler
- 1 large balloon
- paper clip

Note: You will need a flat and level surface, such as a table top, on which to demonstrate the hovercraft.

Original Materials:

Cockerell used a hair dryer, two tin cans, and a kitchen scale (see figure 1).

Figure 1



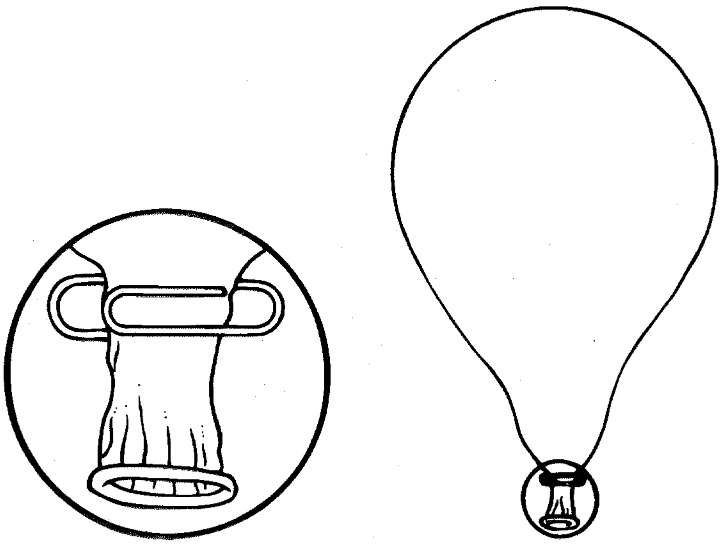
Safety Precautions

Please read and copy the safety precautions at the beginning of this book. Be careful when making the holes in the styrofoam trays.

PROCEDURE:

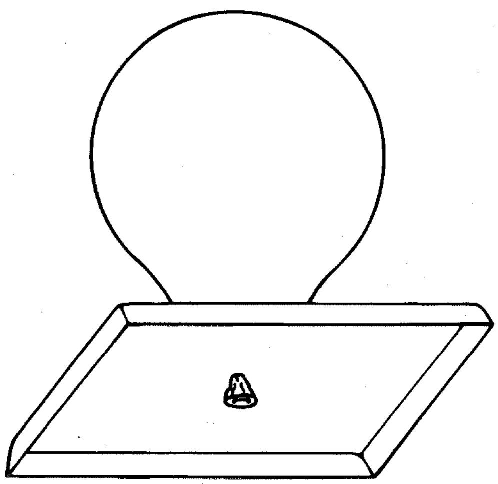
1. Using the awl or cork borer, and working on a cutting board, make a hole in the center of the smaller styrofoam tray, about 7 mm in diameter.
2. Stretch the neck of the balloon and inflate it. Pinch the mouth of the balloon and put a paper clip across the neck of the balloon to seal it (see figure 2).

Figure 2



3. Place the styrofoam tray bottom up and push the opening of the balloon, up to the point where the paper clip is, through the hole in the tray (see figure 3).

Figure 3



4. Put the tray and balloon in the center of the table. Adjust the paper clip by pulling it apart slightly so that sufficient air escapes from the balloon to lift the tray. Gently push the tray and record what happens.
5. Repeat steps 1–4 using the larger styrofoam tray. Record your observations.

ANALYSIS:

1. Describe what happened in step 4 when the smaller tray was gently pushed.
2. Describe what happened in step 5 when the larger tray was gently pushed.
3. Do some research. Account for any differences you saw in the behavior of the two trays.
4. Do some research. In practice, how is a hovercraft propelled forward and steered?

OUR FINDINGS:

Click on above link to see what we found.

SPECIAL SAFETY NOTE TO INVESTIGATORS

Each invention includes any special safety precautions that are relevant to that particular project. These do not include all of the basic safety precautions that are necessary whenever you are working on a scientific investigation. For this reason, it is absolutely necessary that you read, copy, and remain mindful of the General Safety Precautions that follow this note.

Experimental science can be dangerous, and good laboratory procedure always includes carefully following basic safety rules. Things can happen very quickly when you are constructing or demonstrating a model invention. Things can spill, break, even catch fire. There will be no time after the fact to protect yourself. Always prepare for unexpected dangers by following basic safety guidelines the *entire* time you are carrying out the project, whether or not something seems dangerous to you at a given moment.

We have been quite sparing in prescribing safety precautions for the individual projects. We made this choice for one reason: We want you to take very seriously every safety precaution that is printed in this book. If you see it written here, you can be sure that it is here because it is absolutely critical to your safety.

One further note: The book assumes that you will read the safety precautions that follow, as well as those in the box within each project you are preparing to perform, and that you will *remember* them. Except in rare instances, these precautions will not be repeated in the procedure itself. It is up to you to use your good judgment and pay attention when performing potentially dangerous parts of the procedure. Just because the book does not say BE CAREFUL WITH HOT LIQUIDS or DON'T CUT YOURSELF WITH THE KNIFE does not mean that you should be careless when simmering water or stripping an electrical wire. It does mean that when you see a special note to be careful, it is extremely important that you pay attention to it.

If you ever have a question about whether a procedure or material is dangerous, wait to perform it until you find out for sure that it is safe.

GENERAL SAFETY PRECAUTIONS

Accidents caused by carelessness, haste, insufficient knowledge, or taking unnecessary risks can be avoided by practicing safety procedures and being alert while carrying out these projects. Be sure to check the individual projects in this book for additional safety regulations and adult supervision requirements. If you will be working in a lab, do not work alone.

PREPARING:
—Clear all surfaces before beginning projects
—Read the instructions before you start
—Know the hazards of the procedures and anticipate dangers

PROTECTING YOURSELF:
—Follow the directions step-by-step; do only one project at a time
—Locate exits, fire blanket and extinguisher, master gas and electricity shut-offs, eye wash, and first-aid kit
—Make sure there is adequate ventilation
—Do not horseplay
—Wear an apron and goggles
—Do not wear contact lenses, open shoes, loose clothing, or loose hair
—Keep floor and work space neat, clean, and dry
—Clean up spills immediately
—Never eat, drink, or smoke in laboratory or work space
—Do not eat or drink any substances tested unless expressly permitted to do so by a knowledgeable adult

USING EQUIPMENT WITH CARE:
—Set up apparatus far from the edge of the desk or bench
—Use knives and other sharp or pointed instruments with caution
—Pull plugs, not cords, when removing electrical plugs
—Clean glassware before and after use
—Check glassware for scratches, cracks, and sharp edges
—Clean up broken glassware immediately
—Do not touch metal conductors
—Use only low voltage and current materials such as lantern batteries
—Be careful when using stepstools, chairs, and ladders
—Never look directly at the sun with your observation devices

USING CHEMICALS:
—Never taste or inhale chemicals
—Label all bottles and apparatus containing chemicals
—Read labels carefully
—Avoid chemical contact with skin and eyes (wear goggles, apron, and gloves)
—Do not touch chemical solutions
—Wash hands before and after using solutions
—Wipe up spills thoroughly

HEATING SUBSTANCES:
—Use goggles, apron, and gloves when boiling water
—Keep your face away from test tubes and beakers
—Never leave apparatus unattended
—Use safety tongs and heat-resistant mittens
—Turn off hot plates, bunsen burners, and gas when you are done
—Keep flammable substances away from heat
—Have fire extinguisher on hand

FINISHING UP:
—Thoroughly clean your work area and glassware
—Be careful not to return chemicals or contaminated reagents to the wrong containers
—Don't dispose of materials in the sink unless instructed to do so
—Wash your hands
—Clean up all residue and put in proper containers for disposal
—Dispose of all chemicals according to all local, state, and federal laws

BE SAFETY CONSCIOUS AT ALL TIMES