

FACILITATOR GUIDE

Stomp Rockets

Learning objectives

- Some rockets carry science tools—not scientists—into space!
- *Sounding rockets* take quick, low-flying trips into space.
- Scientists use many different kinds of spacecraft to make new discoveries.

Materials

- Two plastic 2-liter bottles (collect more for backups)
- Flexible tubing with tornado maker attachment
- Rigid PVC pipe (rocket-rolling guides)
- Colored copy paper
- Scissors
- Clear tape
- Balloon pump
- *Make your own Sounding Rocket* instructions sheet
- Communication and science tool stickers and info sheet
- *Sounding Rockets* target poster
- Activity and facilitator guides
- Information sheets
- *Tips for Leading Hands-on Activities*

The Explore Science toolkit comes complete with all necessary materials for this activity. Materials are also readily available to create or restock activity kits. To make your own paper rocket launcher you can attach a tornado maker to a 3-foot length of flexible plastic tubing using a heat shrink sleeve. This allows the tornado maker to directly screw onto 2-liter bottles. Use a 1-foot length of rigid plastic tubing as the rocket-rolling guide, and match the outer diameter to the diameter of the flexible tubing, so the paper rockets fit. Graphic files can be downloaded from www.nisenet.org.

Safety

Always aim the rockets away from people. Be sure to hang the Sounding Rockets target poster in a location where you can safely aim toward it.

Advance preparation

Before you begin:

- Screw the flexible tubing to a plastic bottle. This is your rocket launcher.
- Assess your options for hanging the Sounding Rockets target poster at your site. We have provided Command adhesive strips, but if your site does not allow these to be used on the wall, you may use painter's tape instead, or mount the poster to a stanchion sign using large binder clips. Hang the poster about **3 feet off the ground and about 10 feet away** from the table you'll use for the activity.
- Use the balloon pump to reset the rocket launcher between uses.

Notes to the presenter

Guests, especially younger visitors, may need close supervision and help to roll the paper and assemble their rockets. Small hands may have trouble keeping the paper rolled tightly around the tube guide.

If a rocket is having trouble launching, it may be rolled too tightly, causing it to cling to the flexible tubing. Simply adjust the rocket so that it sits just barely on the end of the tubing before launching it.

If many rockets are having trouble launching, it may be time to replace the 2-liter bottle. When this bottle cracks, the air can escape through the bottle walls rather than through the tube and into the rocket. It's a simple job to replace the bottle while guests are busy building their rockets.

This activity can be challenging for young children because of the fine motor skills involved in building the rockets and the strong force with which one needs to stomp on the bottle to launch them. If you are expecting many young visitors, you might consider offering a variety of premade rockets so that young children can select one and try launching it without having to build one of their own. Encourage young children to make observations about how high and far the rockets fly depending on how hard they stomp. Remind them that rockets carry scientific instruments, not just people, which may be new information for them.

Conversational prompts

The Stomp Rockets activity lends itself to many scientific discussions and opportunities. Some museums may use this activity as an engineering challenge, while others work it into lessons on air pressure and the physics of flight. Here, we have framed this activity as imaginative play—rather than focusing on the physics of launching a rocket, we ask guests to imagine the work their rocket could do. Try using this as an opportunity to explore elements of the scientific process such as forming a hypothesis, choosing the right tool for the job, and achieving a goal in spite of constraints. With older participants you may find that you can add some optional extensions to bring back some of the physics content and/or some engineering design-build-test content.

Optional extensions

In a large-group, program, or camp setting, it can be easier to have all guests build their rockets at once, then move onto the launching stage together. Each guest can announce their rocket's mission and tool before stomping to launch it.

Difficult concepts

Guests may only know rockets as vehicles that carry people into space. This activity highlights a type of research rocket that does not carry people. If guests seem uninterested in unmanned rockets, encourage them to imagine why NASA might want to send a rocket without people in it. What do people need to live? How much do people weigh? What do people do well? Just as there are many types of vehicles with wheels (bicycles, cars, trains, etc.) built for different purposes, there are many types of rockets with different purposes, too.

Some guests might assume that the name “sounding rocket” implies that the rocket makes or studies sound. The name actually comes from the boating or nautical term “to sound,” meaning to throw a weighted line in the water to measure the water’s depth. Sounding rockets, therefore, are simply rockets that take measurements.

People may also overestimate how far away space is. The International Space Station orbits Earth at a surprisingly close distance—about 400 kilometers (249 miles) from the surface of Earth! Sounding rockets are used to reach an area above Earth that is too high for weather balloons, and they are ideal for making measurements more quickly and inexpensively than satellites. Those measurements can be of Earth’s atmosphere, but sounding rockets can also measure other space objects or regions.

Staff training resources

Refer to the *Tips for Leading Hands-on Activities* sheet in your activity materials.

- An activity training video is available at vimeo.com/245834960
- A content training video is available at vimeo.com/245835453
- The NISE Network has a curated list of programs, media, and professional development resources in the NASA Wavelength Digital Library that directly relate to the toolkit. These resources can be viewed and downloaded from nasawavelength.org/users/nisenet.

Credits and rights

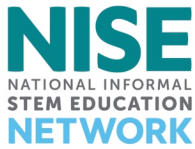
This activity is a classic demonstration that exists in many versions. NISE Net's adaptation was inspired by Paper Rockets developed by Sciencenter.

Image of aurora over the arctic courtesy Terry E. Zaperach, NASA.

Images of Hi-C science payload and sounding rocket component courtesy NASA's Marshall Space Flight Center

Image of *Black Brant IX sounding rocket* courtesy NASA/ Wallops.

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