

STRAW ROCKETS

AT THE EVENT
AGES: 3 AND UP



Group Size	Individual
Duration	5-20 minutes to build the rocket, plus time to launch (more time may be needed if creating the rocket out of the aircraft template)
Materials/ Equipment	Straws, index cards (for fins), cardstock with pre-printed aircraft templates (optional), modeling clay, kid scissors, transparent tape, crayons or colored pencils, straw rocket launchers, measuring tape, painter tape, waste container. Optional – tablecloth and hand sanitizer.
Resources	<p>Straw rocket launcher video: https://video.pitsco.com/default.aspx?VID=670&p=1</p> <p>Straw rockets in Elementary success stories: https://asset.pitsco.com/sharedimages/resources/straw%20rockets%20in%20elementary%20success%20story.pdf</p> <p>STEM Connections: https://asset.pitsco.com/sharedimages/resources/stem/straw%20rockets_stem_2014.pdf</p> <p>Straw Rocket Launcher User Guide (also attached): https://asset.pitsco.com/sharedimages/resources/straw-rocket-launcher-ii-ug-20426.pdf</p> <p>Straw Rocket Class Pack Teacher Instructions which includes student instructions (also attached): https://asset.pitsco.com/sharedimages/resources/userguide/straw_rocket_cp_ug_35784.pdf</p> <p>Rad Rockets Guide PDF (also attached): https://cdn2.hubspot.net/hubfs/2781691/Downloads/Rad-Rockets-Activities-0719.pdf?_hstc=254937367.1b5043f1a137c85575adae76faacc857.1572354792513.1574261890231.1574863751856.17&_hssc=254937367.1.1574863751856</p> <p>Completed straw rocket with aircraft template picture (see attachment)</p>
Objective	<p>Students will build and launch rockets constructed from kit materials (straws, modeling clay, and index cards or fin templates). Students use the Pitsco straw rocket launcher to launch their rockets, typically in a gym or hallway with a tall ceiling. The launch force and launch angle can be varied by the student, affecting the flight of the rocket. The student will try to launch the rocket into a predetermined space used as a landing area.</p> <p>Standards:</p> <p>NGSS.3-PS2-1 Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.</p> <p>NGSS.3-PS2-2 Make observations and/or measurements of an object’s motion to provide evidence that a pattern can be used to predict future motion.</p> <p>NGSS.3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.</p>

	<p>NGSS.3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem</p> <p>NGSS.MS.F1 Forces and Interactions</p> <p>NGSS.MS-PS2-2 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.</p> <p>NGSS.MS.ED Engineering Design</p> <p>NGSS.MS.ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.</p>
Preparation	<p>This activity will require 2 or more adults to run stations. At minimum, one adult will need to be stationed at the straw rocket building and one adult will need to be stationed at the rocket launch area. It is recommended that at least 2 adults are at each station.</p> <p>Before the event, create two straw rockets to be used as visual aids, one rocket using fins and the other using the aircraft template. See below for instructions on how to build a basic straw rocket. Have each adult working at launch station review the Straw Rocket Class Pack Teacher Instructions and the Straw Rocket Launcher user guide and have available at the table. Print copies of the optional aircraft templates based on attendance.</p> <p>Have the following materials to build straw rockets on the table so that multiple students can build at one time: straws, index cards for fins, cardstock with premade fin templates (optional), modeling clay, kid scissors, transparent tape, crayons or colored pencils, waste container, hand sanitizer (optional), table cloth (optional). It can be helpful to have fins precut and small pieces of clay ready on the table as well.</p> <p>At the launching area, have the straw rocket launchers in place. Use the measuring tape to create 24" squares with painter tape to use as the landing area (the shape and size of the landing area can be adjusted as you see fit). The straw rocket launchers are recommended for use in a large, open area (the rockets can travel 50 feet). The launchers will work best in an area where attendees do not walk in between or in front of the launch area.</p>
Procedure	<p>Using the provided materials, have students build a straw rocket at the straw rocket station. Allow them to decide if they would like to create fins out of index cards or if they would like to use the aircraft template so they have a two-sided fin. Students may need assistance taping and cutting. Have the two sample straw rockets that were prepared prior to the event on the table to assist with any questions.</p> <p>After they build the rocket, have them move to the launching station. Have the adult explain to them that the goal is to get the straw rocket to land inside the landing area. Explain that they should never launch straw rockets at people and that they should make sure that all people are clear of the rocket's anticipated flight path. The adult at this station should ensure that the rockets are being properly launched and that the launchers are being properly used. Adults should be sure that the launcher base remains on the ground for the entire launch. The weighted drop rod should be released from the fingertips, not pressed or pushed down.</p> <p>Have the adult explain how to launch the rocket at a 45 degree angle. The students will need to experiment with the force to get the rocket to land in the landing area. In order to do this, they will vary the release height of the weighted drop rod (only one variable should be changed at a time, for example, the variable changed here is the force). If time permits, discuss with the student the importance of only changing one variable at a time.</p>

	<p>If the angle needs to be adjusted, keep the force constant (the weighted drop rod would be released from the same height) while adjusting the angle (again, change only one variable at a time).</p> <p>After the launch, have the student collect their straw rocket. If they did not hit the landing area, they may go back into the launch line while brainstorming ideas on how to hit the landing area on their next launch. Students may take home their straw rocket.</p> <p>Extension activities: Browse the Rad Rocket activities to find additional templates that can be used based on when your event is taking place. For example, if the event is held near Valentine's Day, cupid fins may be selected. Please note, for the extension activity, additional materials are not provided. The materials/equipment list would need to be adjusted for the type of fin you would like to print. The painter tape will be used to create a landing area on the floor. Feel free to adjust the size or location of the landing area based on your event needs.</p>
Potential Questions	<p>What is force? How do you think you will adjust the force with the launcher? What is mass? How would you change the mass of the rocket? What would happen if you changed the mass of the rocket? What is a variable? Why is it important to only change one variable at a time?</p>
Air Force Connection	<p>According to Career One Stop, the definition of an Aerospace Engineer is one who performs engineering duties in designing, constructing, and testing aircraft, missiles, and spacecraft. An Aerospace Engineer may also conduct basic and applied research to evaluate adaptability of materials and equipment to aircraft design and manufacture and recommend improvements in testing equipment and techniques.</p> <p>https://www.careeronestop.org/videos/careeronestop-videos.aspx?videocode=17201100</p> <p>Browse the website https://www.airforce.com/careers/browse-careers/ to find 13 careers related to aerospace in the Air Force.</p> <p>For example, one aerospace career is Aerospace Propulsion. In this career field, the responsibility is to ensure that all of the plane's engines are in first-rate operational conditions. Aerospace Propulsion specialties test, maintain, and repair all parts of the engine. This career field plays a critical part in keeping planes and Airmen safe in the air.</p> <p>https://www.airforce.com/careers/detail/aerospace-propulsion</p>

Steps to Build a Basic Straw Rocket



1. Design a rocket. Determine the fin shape, number of fins, rocket length, and nose cone shape. Students can also use one of the premade templates as fins (such as the aircraft).
2. Draw the chosen fin shape on an index card, drawing as many fins as you wish to have on your rocket. There are usually two to four fins per rocket. If a template is used, those will be the fins.
3. Using scissors, cut out the fins.
4. Cut the straw to the desired length with the scissors; the straw is the rocket body.
5. Cut or tear pieces of tape the length of the edge of the fin that is to be connected to the rocket body. Place the tape on the edge of the fin and repeat for all fins.
6. Attach the fins so that they are evenly spaced around the straw. Carefully trim off any excess tape.
7. Knead the clay to soften it, and carefully shape the clay to match your nose cone design.
8. Press the clay nose cone on top of the straw rocket body. Some of the clay should go inside the rocket body. The outside edge between the straw and the nose cone should be sealed carefully with clay because any gaps where air can escape will cause the rocket to not launch properly.
9. Your rocket is done! After making the rockets, direct the students to the launching area and have them launch the rockets using the straw rocket launcher.

Note: Preparing fins, cutting rocket bodies, and pre-sizing clay can be done before the event to allow a faster pass through rate. Smaller children may need more assistance with assembly.

To Launch:

1. Slip the straw rocket over the launch tube.
2. If the launch tube moves while putting the straw rocket on, carefully move it and the rocket back in line with the desired trajectory angle (45 degrees provides a nice launch). Remind students to be very careful when moving the launch tube.
3. Raise the launch rod to the desired height. By varying the launch rod height, which is calibrated in centimeters, the students can control the distance of the rocket's flight. Ensure that the launcher base remains flat on the floor.
4. To launch, release the launch rod so that it falls to the bottom of the cylinder. This action compresses the volume of air in the cylinder and forces it out of the launch tube, blasting the rocket away from the launcher. Note: When rockets are launched, simply release or drop the launch rod. Avoid forcing the rod into the cylinder.

Note: Smaller children may need more assistance with launching.