RAMP UP – LIFTOFF Lesson Plan

Title of Lesson:	Collecting and Analyzing Data with Straw Rockets
Grade Level:	2
AL COS Standard:	SC15.2.2 - Collect and evaluate data to determine appropriate uses of materials based on their properties (e.g., strength, flexibility, hardness, texture, absorbency). MA19.2.16 - Create a picture graph and bar graph to represent data with up to four categories.
NGSS:	K-2-ETS1-2 - Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
Learning Targets/Objectives:	● I can gather data from multiple trials to gain an understanding of how different fin placement and shape affect the distance of the straw rocket. ● I can analyze the data gathered.
Materials Needed:	● **Videos:** ○ Rockets 101 | National Geographic - https://www.youtube.com/watch?v=1yBwWLunlOM ○ Why Do Rockets Have Fins? - https://www.youtube.com/watch?v=s5Nzpet8-nI ● **Worksheet** ○ Collecting and Analyzing Data with Straw Rockets: Results Sheet ● **Website** ○ NASA Science Space Place - https://spaceplace.nasa.gov/launching-into-space/en/ ● **Other Materials** ○ pencils

	○ tape measure ○ colored tape (to mark where rockets land) ○ poster paper or dry erase board ○ marker ○ phone or camera to take pictures ○ clipboards (if students want to use them to hold their recording worksheets) ● **RAMP UP LIFTOFF Kit** ○ All materials needed for the LIFTOFF experiment are included in the kit. Links to the videos, worksheet, and website can also be found on the LIFTOFF Kit Resources page https://uahrampup.org/liftoff/
Preparation:	● Follow directions to put the two launchers together ● Gather materials ● Determine a safe area with plenty of room to test rockets. Use 2 pieces of tape on the floor about 30 feet long. Use the tape measure and mark the feet/inches on them. This is where the lanchers will be placed so the students can measure their launches. ● Determine a start date that works to complete all three days. ● Prep video so you don't have to wait through an advertisement.
Lesson Logistics:	● This activity can be done over three days. ● There will need to be plenty of time for the exploration of the straw rockets. ● Each student will have their own rocket. They will need to take turns testing it with the launcher. ● They will change the shape of their rocket and test again. ● For this lesson, the only variable change will be the shape of the rocket.

	● You will need to set the angle to 45 and pull the plunger all the way to the top each trial. ● There will need to be a big open space to test the rockets (ex: outside, gym, hall).
Vocabulary Words:	● potential energy ● kinetic energy ● piston ● spring ● compression ● data ● analyze ● hypothesis ● horizontal
Safety Considerations:	● Students will need to take turns and make sure other students are behind the launcher before launching their rocket to avoid hitting them. ● Goggles will protect eyes.
Engage: **Day 1 (15 min)**	**Step 1:** Ask students, "What do you know about rockets?" Record their answers on the board or a large piece of paper. **Step 2:** Show the Rockets 101 | National Geographic video. **Step 3:** Ask students, "What did you notice about the rockets?" "How do you think the shapes changed the rockets?" Explain that we will build straw rockets and ask, "How do you think the shape of the rocket you build will affect how far it goes?" Record students' hypotheses.
Explore: **Day 1 (45 min-1hr)**	**Step 1:** Explain that the target of the lesson is to try different rocket shapes and determine which shape helps propel their rocket the farthest. **Step 2**: Give students the scissors, tape, straw, ear plug, and index card. have them make two cuts at the bottom of the ear plug. Then twist and insert it into the straw.

	Step 3: Introduce the Collecting and Analyzing Data with Straw Rockets: Results Sheet. Have students make a plan and draw what their rocket will look like in the first picture box on their recording sheet. Then have them create it with the index card. They will cut the card to make fins and tape them where they want them. **Step 4:** Once students have their rockets ready, set expectations. One person at a time at the launchers. Everyone behind the launchers. Make sure you are wearing your safety goggles. (any other expectations you have for your class.) **Step 5:** Explain that we are only changing one variable. The launcher will stay on 45 and each student will pull the plunger to the top and let it drop each time. **Step 6:** After the first two students have launched their rocket, have them use the tape measure on the floor to record the distance the rocket traveled. Then they can draw in the next spot on their record sheet how they will change their rocket and begin changing it as the next two are launching. Continue allowing students to take turns and change their rockets until all students have three turns recorded. **Step 7**: Take up everyone's record sheets. Ask students what they learned during the experiment. Why do they think that happened? How did the distance change each trial for them? Why?
Explain: **Day 2**	**Step 1:** Introduce the vocabulary that will help students understand the rocket and how it worked. Especially vocabulary needed during discussion. **Step 2:** Look at student hypotheses previously recorded and compare and contrast results with hypotheses. **Step 3:** Let's look at the data we collected. Make a graph for the number of fins/distance. Fill it in as a class. Is there any significant difference between the number of fins and distance traveled? Make a chart of the shape of fins/distance. ex: triangles, rounded, rectangles)

	Is there any significant difference between the shape and distance traveled? What does this data tell us about how the shape of the rocket changes the distance? Does this correspond with our hypotheses? **Step 4:** Guide discussion of patterns/trends students noticed. Answer any question students may have about their results. Questions to ask students: What did you notice during the experiment? What do you still wonder? Record anything students still wonder. **Step 5:** Watch the video Why do Rockets Have Fins?
Extend: **Day 3**	**Step 1:** Review the wonderings from the day before. Ask "What are some ways we can answer these questions?" In groups of 4, have students explore the things they are still wondering about. Assign one question/group. They can use the article on the spaceplace.nasa.gov website to help. Then have them present their question and answer to the class. They can use drawings or writing.
Evaluation: **Day 3**	Evaluation can be completed according to the teacher's discretion. Suggestions for evaluation options include: ● No formal evaluation. Use formative assessment strategies throughout the phases. The presentation, recording sheets, and discussions can be used to evaluate. ● Have students write one thing they learned about rockets.