STEM Activity Module:

MINI STRAW ROCKETS

Developed by Laura Gordon, Engineering Student Ambassador, 2019

UAA College of Engineering
UNIVERSITY of ALASKA ANCHORAGE

Grade Level:
Grades 5+

Volunteers:
2-3

Space:
Student work area, large open area for Launch Zone.

Time Commitment:
- 30 min of prep
- 60-75 minutes to complete. Lesson can be adapted to fit available time.

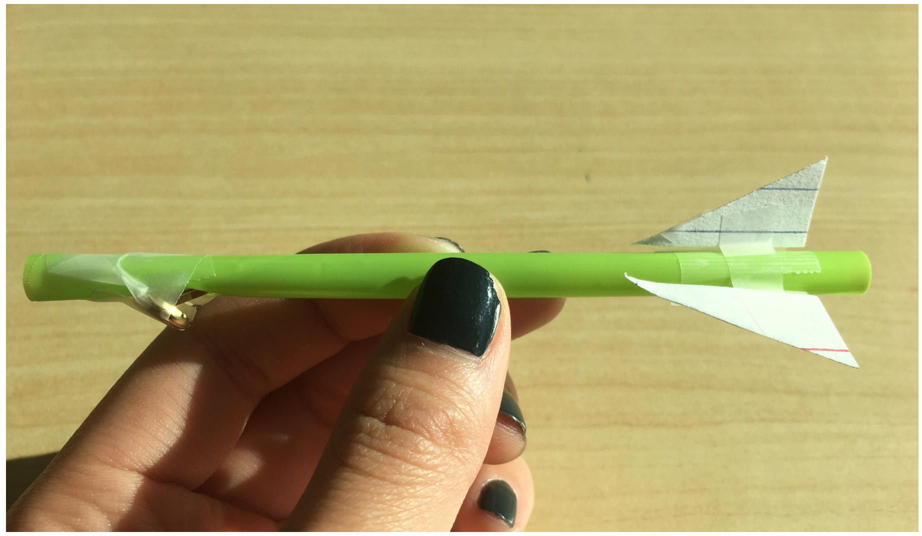
Objective:
Students use provided materials to build a miniature straw rocket that can fly furthest and most precisely, measured by the rocket hitting a target. Students will test different designs to perfect their rocket through the engineering design process.

Provided Kit Materials:
- 1 Lesson plan
- 1 Final challenge target
- Digital files of student challenge cards

Additional Materials Needed:
Construction Materials Kits (1 kit per student)
- 1 Plastic bag
- 1Drinking straw, cut in half
- 1 Brad
- 1 Rubber band
- 1 Large paper clip
- Printed student challenge cards

For the Student Work Area
- Small paper clips
- Note cards
- Scissors
- Scotch tape or masking tape
- Sharpies

For the Launch Zone
- Colored tape to mark distances.



Preparation & Setup:
Assemble Kits: Cut straws in half. Combine materials for students into bags to make kit distribution easier. Student handouts can be distributed one challenge at a time.
Student Work Area: if students are seated in groups, distribute Student Work Area materials to each group. Otherwise, collect these materials at a single location that can be accessed by all students.
Launch Zone: Outline a large open space for the launch zone and place the laminated target at the far end of the launch zone.

Plan:
1. Build basic rocket and record data on the rocket's flight.
2. Modify one element at a time and record data.
3. Build a revised rocket that flies straight and far to hit a target.

Running the Activity:
- Rocket build instructions can be delivered through whole group instruction via google slides or individual student challenge cards.
- If needed, distribute the instructions one challenge at a time. Students build the original rocket design before making modifications.
- Demonstrate the correct way to load and fire a rocket using a sling shot before the students test their rockets.
- Discuss the relevant steps of the engineering design process before each step and share findings after each challenge.
- Remind students to record test data for each rocket design, with a note of which modification was made.
- The target for the final challenge can be moved to wherever is appropriate for the group.

Judging & Awards:

The students whose modified rockets reach the target will win prizes.

Safety Tips:

Rockets may only be tested at the Launch Zone. Never fire a rocket at another person. Rockets should be retrieved from the Launch Zone as quickly as possible, in consideration of others waiting to launch.

One volunteer must supervise the Launch Zone so that:

- No one walks through the zone while rockets are being fired.
- Students quickly retrieve their rockets and not linger in the Launch Zone.
- Rockets are not being launched outside of the Launch Zone.

Engineering Concepts:

Energy

The rockets fly through the air because they receive energy from the slingshot. When the rubber band is stretched, it has **potential energy** (energy stored in an object). When the rubber band is released, it exerts a **force** (a push or pull) on the rocket, and the **potential energy** is converted into **kinetic energy** (energy of motion).

Momentum

The rockets are able to fly further when weight is attached to the body. This is because objects with a greater **mass** have greater **momentum.**

Momentum = Mass x Velocity

When a rocket flies through the air, it experiences **drag. Drag forces** push against the rocket, slowing it down. The more **momentum** a rocket has, the better it is able to resist **drag.**

Drag is proportional to Velocity^2 x Area.

Drag is also the reason why fins help a rocket fly straighter. When a rocket starts flying crookedly, the fins experience a **drag force** against them, causing the rocket to straighten again. However, if the fins are too large, they will create a large **drag force** that will slow the rocket down and shorten its flight.

Follow Up:

If facilitating this activity in a classroom, or in an event structure that allows follow up to the activity, use these discussion questions to guide students through reflection and learning:

- Which rockets flew the furthest? Why do you think that is?
- Which rockets had the greatest momentum? Energy?
- Where there any results that surprised you? Why do you think they occurred?
- How could you use these discoveries in the real world?

For more resources and information on the Engineering Design Process, visit www.uaa.alaska.edu/engineering/stem-education

Classroom Extensions:

For students familiar with algebra, the Mini Straw Rocket can be used to teach any of the following topics:

- Forces and free-body diagrams
- Energy and momentum equations
- Position, velocity, and acceleration in free fall
- Trajectories and launch angles

This activity was modified from “How to Make Slingshot Straw Rockets—Engineering Projects for Kids,” from the YouTube channel Lance Makes: https://www.youtube.com/watch?v=7B1TGHP7yx4