SUPERNOVA at Dalhousie University

Title

Slingshot Rocket

Activity Overview

Description

By constructing and testing a slingshot rocket, each student will comprehend basic aerodynamic principles such as stability, drag, and lift. Redesigning the rocket after testing it offers students the opportunity to apply their newfound knowledge to create a higher performing rocket, which in turn promotes further insight into aerodynamics. Students will also gain an experiential understanding of fundamental physics principles as they launch their rockets, such as stored energy, trajectory, and Newton's laws of motion.

Topic Area(s)

Aerospace, Mechanical, and Aeronautical Engineering

Grade Level

1-5

Duration

1 hour

Learning Outcomes:

Participants will:

- Understand the engineering design process and apply it in a hands-on activity
- Learn to experiment and improve their design based on test results.

Background Information

Rockets are spaceships which are propelled into space at greater force and speed. A rocket and any other flying object has four forces working on it: lift, drag, weight, and thrust. Lift is the force that works in the horizontal direction, keeping the rocket above the ground. Lift must partially overcome the weight of the rocket in order for it to keep flying above the ground. It also is responsible for stabilizing and controlling the direction of flight. Drag is the force working the opposite direction of the movement of the rocket. Think of it like this: when you are pulling a sled, you must overcome the drag of the sled and snow in order to get it moving and to keep it in motion. Drag is the force that slows down movement, and is usually much greater than the force of lift in a rocket. Weight is the downward force of the rocket. Weight is the force pulling the rocket back to Earth, and is connected to gravity. The greater the mass of

the rocket, the greater the force of gravity acting on it. Thrust is the upward motion that opposes the force of weight. Thrust is the force pushing the rocket up into the atmosphere.

Newton's Third Law Sir Isaac Newton created three laws of motion, which are true for all moving objects. One in particular, his third law, is especially important to the movement of rockets. Newton's Third law states: "For every action, there is an equal and opposite re-action". This is the same situation as on a see-saw. When one person goes up, the other person goes down. Thrust pushes the exhaust flow backwards and pushes the engine (therefore the rocket) forward in a great push. In our project the source of thrust is the rubber band.

Materials

Per student:

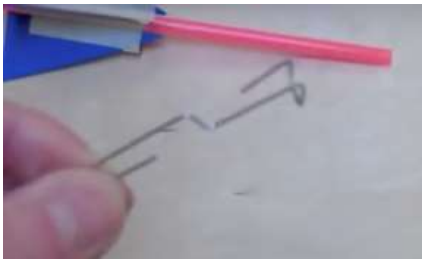
- 1 straw
- Half a sheet of cardstock
- Masking tape (approx. 30 cm)
- 1 elastic
- 1 popsicle stick

Safety Considerations

Scissors must be handled with care.
Participants may need help bending paper clips.
No flinging rubber bands at each other.
No chewing on straws.
Always aim the slingshots away from people.

Procedure

1. Cut out two equal size rectangles and then cut those diagonally in half. This makes 3 triangular fins. As you cut out the fins, explain that their purpose is to stabilize the rocket's trajectory, or the path it follows through the air. Without the fins, any small disturbance in the air will cause the rocket to tilt off course and crash. Although students may experiment, explain that one or two fins will not work as well as at least three. One fin is unbalanced, and two fins can act like wings, which will create lift: a rocket that generates lift will fly sharply upward and stall. The fins must also be straight or else the air flowing over them will push the rocket off course.
2. Tape fins firmly around one end of the straw evenly spaced.
3. Next bend paperclip in a such a way as to create a hook. Attach (tape) this to the end of the straw that doesn’t have the fins taped to it.



4. Separate: Tape a rubber band to popsicle stick making the slingshot. Make sure rubber band is at tip of popsicle stick for best launcher.
5. Launch the rocket by putting the elastic around the paper clip and pulling the rocket back towards yourself then letting go.
6. Make adjustments to fins/design as necessary to create the best possible rocket!

Wrap-Up/Debrief

Eg. Group discussion points:

- What did campers think was the most interesting part of the project?
- If they were to build a rocket again, what would they do differently? What would they keep the same? (put emphasis on the number and placement of fins for this question)
- What factors need to be considered when building a rocket?

Additional Resources

- http://www.instructables.com/id/Teach-Engineering-Slingshot-Rockets/