Launch It!

There were so many great Engineering Design Challenges to choose from. I loved how each of these came with great background information for students along with some reading about what they are planning to do in the future. I looked at all the challenges and decided to have my group of students work on the "Launch It!" Challenge. I liked how this one had students test their rockets at different angles and then to see if they could improve their design and make their rocket fly further and hit the target.

Phase I – Research and Planning

The "Big" concept to be covered by the engineering design challenge

Potential and kinetic energy

Distance-angle relationships of an object in flight

This challenge will help students to have a better understanding of how potential energy can be stored and can be changed to kinetic energy when pressure is applied.

Students will also learn that when they launch rockets at different angles that the travel distance and shape of the flight path changes.

Learning standards associated with the topic

NGSSMS-PS3-2

Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. Emphasis is on relative amounts of potential energy, not on calculations of potential energy. Examples of objects within systems interacting at varying distances could include: the Earth and either a roller coaster cart at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a classmate's hair. Examples of models could include representations, diagrams,

pictures, and written descriptions of systems. Assessment is limited to two objects and electric, magnetic, and gravitational interactions.

NGSSMS-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. Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units. Assessment is limited to forces and changes in motion in one-dimension in an inertial reference frame, and to change in one variable at a time. Assessment does not include the use of trigonometry.

NGSSMS-PS3-1

Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object. Emphasis is on descriptive relationships between kinetic energy and mass separately from kinetic energy and speed. Examples could include riding a bicycle at different speeds, rolling different sizes of rocks downhill, and getting hit by a wiffle ball versus a tennis ball.

NGSSMS-ETS1-3

Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

Different types of problem solving and declarative/procedure knowledge needed.

This would require moderately structured problems because there are different strategies and adaptations that fit this problem. Students can come up with similar solutions even if they use different strategies to get to those solutions. There are also more than one acceptable solution strategies that can be used. Students will need skills of mental modeling and they must invent a strategy which suits the context.

The declarative knowledge that students will need is that students will need to understand that rockets are used by NASA to carry things into space. They will also need to know the parts of rockets.

Objectives and ancillary concepts/content covered by the project

Students will design and build a straw rocket that is air powered.

Students will test their rockets and record data.

Students will change the angle of their rocket and make observations.

Students will adjust their rocket, if needed.