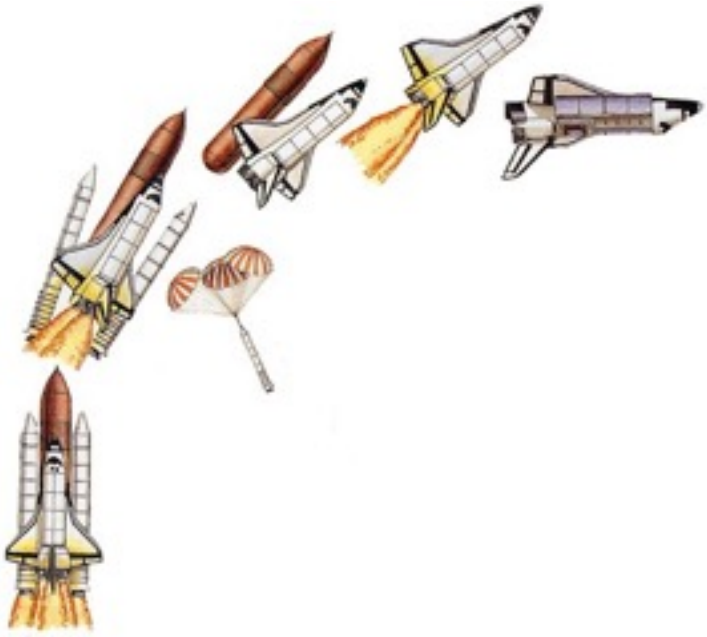
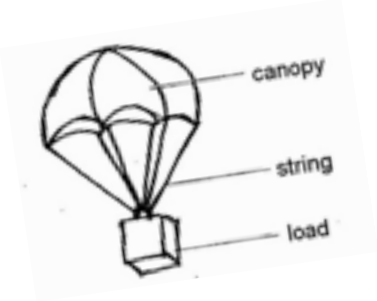
To Boldly Go . . .
and Return!
Destination: Space





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Introduction

To Boldly Go … and Return!

Since this unit is meant to be useful for several grades, there are a range of ways to get students going on the lessons. If a class is already studying the solar system or space, one could pick and choose one or all of the lessons contained in the unit. They've been sequenced in a way to build up the students' understanding and familiarity with the engineering design process and issues involved in human survival in the extreme environment of space.

Most of the lessons are adaptations of ideas and projects that are used by many educators, but with the Next Generation Science Standards (NGSS) coming into effect, I've attempted to emphasize and enhance the engineering elements. The two main overarching NGSS Engineering Practices I focused on were Analyzing and Interpreting Data as well as Developing and Using Models.

One underlying component of the new standards is the belief that children need to imagine, create, attempt and improve solutions to problems. This is known as the engineering design process. Each lesson gives students a goal and limited supplies and directions to achieve it. In engineering these are known as criteria and constraints. The criteria is the stated objective. The constraints are the parameters they must work within, such a certain amount of materials or time. What's exciting about the new standards is that they position the teacher more as a facilitator rather than the fount of knowledge from which all information is gained. Developing engineering practices as a core component of education teaches students the value of collaboration and testing ideas. They learn from "failures" and become flexible in accepting and discarding theories based on evidence. When they can test their ideas and see their results they readily try something new because engineering taps into an inherent desire to find a solution.

There are many ways to start this unit, but a logical progression could begin with looking at the problem of how we get into space. Some students might be more intrigued with designing a spacesuit, so it's up to the discretion of the teacher. Beginning the unit working with rockets though starts it off with a bang.

"Kids should be allowed to break stuff more often. That's a consequence of exploration. Exploration is what you do when you don't know what you're doing".

~ Neil deGrasse Tyson

Pre-Unit Considerations

Before beginning the Space Exploration Unit it would be helpful if students have some familiarity with measuring lengths and distances. Several of the lessons involve measurement and offer the opportunity to develop this skill in a practical way.

Optional
Model Rocket
Kick off the space unit by launching model rockets.
Pre-launch
Compare the shape and weight off two different rockets.
Discuss why rockets (and other vehicles) have aerodynamic shapes.
Note the fins which help guide a rocket.
Have students predict which rocket will go highest.

NGSS Engineering and Science Practices

Grades K - 2

1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
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.
3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

Grades 3 - 5

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.
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.
3. Plan and carry out fair tests in which variables are controlled and failure points a re considered to identify aspects of a model or prototype that can be improved.

NGSS Standards by Grade

K - Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.

- Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.

3 Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

- Make observations and / or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.

4 Use evidence to construct an explanation relating the speed of an object to the energy of that object.