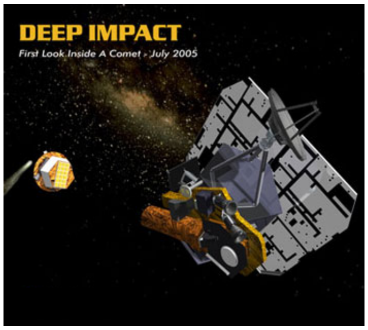

"Paper Comet Model With a Deep Impact"

An option to the "Comet on a Stick"

Created for Deep Impact, A NASA Discovery Mission
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Student - Inquiry

Purpose:
The Paper Comet is an option to "Comet on a Stick" using instead an 8 ½ X 11 piece of paper which is less expensive than the Styrofoam version. Develop a model of a comet and use the same thought processes as a science and engineering team do to design and build missions. Use it to test your theories about comets and then evaluate the strengths and weaknesses of your comet model. The importance of the activity is not the initial model, but the model you improve or design and your evaluation of the initial model. During the second part of the activity, you will work with a team to decide what kind of new model you would like to build.

Project:
The **Deep Impact** mission launched in 2004 and encountered Comet Tempel 1 on July 4th of 2005. Before launch, scientists and engineers used modeling to research and test some of their theories about comets. They also used modeling to find solutions to some of their mission challenges. Modeling takes place throughout the life of a mission as challenges arise. You can try modeling by making a "Comet on a Stick." Use it to test the influence of the Sun on these small bodies. Discuss as a class some theories about comets. Then try to communicate them with the stick comet. This is a good model for some of the attributes of a comet. For others, it is not. During the activity, you will have the opportunity to decide the strengths and weaknesses of this comet model. You will also get to improve this model or build an entirely new one. If you need to know more about comets, visit http://deepimpact.jpl.nasa.gov to learn more about the Deep Impact mission.

Before you start:
As a class, discuss what is or might be true about comets. Build one list. Add to that list the things you wonder about comets or don't know. Build a model to study the following question: If you have to send a spacecraft to a comet, what will you need to consider about the way the Sun affects a comet? Now, build a "Comet on a Stick".

Materials:
One 8 ½ X 11 piece of paper
Two 1 - 2 ft lengths of mylar gift strips, raffia or ribbon
One 5" strip of tape
One wooden skewer (shish kabob type)
An electric hairdryer/electrical power available
One marker pen
Gather household or art supplies for students to use to design their own comet models.

Directions:
1. Mold the sheet of paper into the shape your team believes should represent your comet nucleus and attach it to the top of the wooden skewer or straw.
2. Place the mylar strips on top of the paper nucleus so the two pieces cross each other in an "X" and the lengths of all sides of the strips hang down evenly. You can also use light ribbon.
3. Attach the strips to the paper with the 5" strip of tape or narrow masking tape wrapped over the strips and around the circumference of the nucleus.
4. With a marker pen, assign a "front" for your comet and represent it with the letter "H" for head. On the opposite side, mark the letter "T" for tail of the comet.

<u>Here's what you do:</u>

Use a hairdryer to simulate a portion of the Sun's solar energy as it meets the comet. The heat from the Sun warms the surface of the comet nucleus. This causes gas, ice, particles and rocky debris of various sizes to burst from the comet in all directions (called coma) and the solar wind causes these substances to flow back behind the nucleus to form a "tail" behind the comet. Have someone be the "Sun" and stand in place with the hairdryer. The hairdryer simulates the solar wind causing the comet "tail" to form and trail behind the comet. Aim the hairdryer at the comet and keep it trained on the comet as it approaches and as it moves away. Have a second person hold the comet by the stick and walk in an elliptical (elongated or oval) orbit around the Sun. As the comet gets closer to the Sun, the Sun's solar influence affects the comet so that the gas and debris forms a tail that is pushed toward the back of the nucleus. This tail flows in opposition to the Sun so that the nucleus is between the Sun and the tail. As it travels away, the lost influence of the Sun causes the tail to diminish or in this case, fall. The solar wind from the Sun, which is made of electrically-charged particles, uses electrostatic attraction and electrical transfer to form the comet's gas and debris into a tail.

<u>Questions:</u> Use the materials you gathered to have the students improve or build new models.

1. What are the strengths of this model for showing the influence of the Sun on a comet?
2. What are the weaknesses of this model for showing the proper influence of the Sun?
3. What other facts or theories about a comet can be seen using this model?
4. Which facts or theories of a comet are not well shown by this model?
5. Can you improve the model by changing it or making an entirely new model?
6. Can you build a model that shows what a comet does in space as opposed to what it is?
7. The Deep Impact mission makes a crater in the nucleus of Comet Tempel 1 with a copper projectile. A sister spacecraft nearby takes optical and spectrometer data during the encounter and for 14 minutes after impact. What do they need to consider about a comet in order to successfully gather their data?
8. Form teams and choose three facts, theories or characteristics about comets you would like to show through modeling. Make a new model or improve your current model.
9. Or, as a team, decide what kind of comet mission you would design. Take one of the challenges you will face and try to create a model that will help you find a solution for your challenge.
10. Once your team has designed your comet model, show it to the other teams without explanation. See if they can identify what you were trying to show about a comet. How well did you collaborate as a team to build a clear and accurate model?

Questions? Contact: Maura.Rountree-Brown@jpl.nasa.gov