KITES

Lesson Plan: Double-Pocket Sled Kite

Grade Level: 7-8

Subject Area: Science and Math

Time Required: ***Preparation:*** 1 hour
Activity: 2-3 hours

National Standards Correlation:

Science (grades 5-8)
- Science as Inquiry Standard: Understanding about scientific inquiry.
- Unifying Concepts and Processes Standard: Evidence, models, and explanation.
- Science as Inquiry Standard: Abilities necessary to do scientific inquiry.

Math (grades 6-8)
- Geometry Standard: Use visualization, spatial reasoning, and geometric modeling to solve problems.
- Algebra Standard: Represent and analyze mathematical situations and structures using algebraic symbols.
- Measurement Standard: Understand measurable attributes of objects, and the units, systems, and measurement.

Summary: Students will build a double-pocket sled kite using an integrated math/science approach. They will utilize skills associated with blueprint construction, pattern creation, and kite building, while following a given set of directions. They will also apply certain mathematical formulas, such as surface area, and the principles of flight to the kite that they create. Finally, they will learn to use appropriate flight and kite terminology when describing how and why their kite flies.

Objectives: Students will:
- Construct a blueprint of a given kite.
- Use proportions to create an appropriate pattern for a kite.
- Build a kite according to certain specifications.
- Calculate the surface area of the kite they create.
- Attach a bridle string/tow point to the kite they create.
- Fly the kite, using correct safety instructions and flying methods.
- Evaluate the kite according to Bernoulli's Principle and the four forces of flight.

Background: There are four forces that act on an object in flight: lift, gravity, thrust, and drag. Lift causes an object to rise, gravity causes an object to fall, thrust causes an object to move in a given direction, and drag causes resistance to the object's motion. When designing a kite, these four forces will need to work together to ensure flight. Careful attention will need to be paid to the design of a proper bridle string and tow point – two important details that establish a proper angle of attack. Students will have to incorporate mathematical and scientific skills in cooperative groups to accomplish this task. This is an excellent way to integrate learning in two disciplines.

Originally published as part of *Project SOAR™: Science in Ohio through Aerospace Resources, Volume I-III.* Dayton, Ohio: The National Museum of the United States Air Force and The Air Force Museum Foundation, Inc. 1997-1999.

Materials: Each group of three students will need:

- 1 large garbage bag, 30 - gallon size
- 3 dowel rods (each 3/16” x 26”)
- Strapping tape (for taping dowels to trash bag)
- Masking tape (for securing pattern to trash bag)
- Graph paper
- Pencil
- Hole puncher
- Ruler or meter stick
- Protractor
- Scissors
- Erasable markers
- Flying line (medium weight)

Safety Instructions: See “Kites in the Classroom” presentation at http://www.nationalmuseum.af.mil/shared/media/document/AFD-070523-007.ppt

Procedure:

A. Warm-up

1. Review measurements and proportions. Do this by going over a review worksheet in math class.

2. Review principles of flight (lift, gravity, thrust, drag). Use a visual that illustrates these principles of flight.

3. Review and demonstrate kite terminology (keel, bridle, tow, flying line). Use a previously constructed kite for this.

B. Activity

1. Give each group of students a scaled drawing of a double-pocket sled kite (see figure A).

2. Instruct each group to create one blueprint (to scale) of the kite. Use graph paper, ruler and pencil for this. Students can determine scale, as long as it is accurately drawn. Right angles should be checked, with a protractor, to ensure accuracy.

3. Once the blueprint has been checked by the teacher, create a pattern (actual measurements) for the kite. Use sheets of newspaper or roll paper for the pattern. Carefully measure angles and draw lines using ruler or meter stick.

4. When the pattern has been traced and checked by the teacher, have students cut it out and throw remaining scraps away.

5. Attach the pattern (using very small bits of masking tape) to the fold of a trash bag. Carefully trace around the pattern using a light-colored, erasable marker. This will show up on a black trash bag under room lights.

6. Remove the pattern and cut out the kite, making sure to ALSO cut along the fold. TWO pieces of the pattern, separate from one another, should remain. Gliding scissors along the trash bag, rather than cutting, produces smoother edges. If marker lines still show, they can be wiped off.

7. Using strapping tape, fold each piece of the kite along CD and tape the two kite pieces together along this line (see figure B).

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8. Now bring edges AB across to EF (on each piece) and tape them in place, creating a tube on each side (see figure B).

9. On the reverse side of the kite (opposite pockets), tape dowel rods along both sets of AB and the adjoined CD (3 dowels total, each 26” in length).

10. Reinforce each dowel with one 26” strip of tape that runs from the top of the kite to the bottom. This ensures that air will not pass between the dowel and the kite, causing it to rip.

11. Reinforce wing tips with one to two pieces of strapping tape, and punch a hole in tips for the bridle string.

12. Construct bridle string using flying line. Measure a piece of string five times the length of the dowel rods.

13. Using a square knot, attach each end of the bridle string to the wing tips (see figure C).

14. Once the bridle string is attached to the wing tips, bring the wing tips together and find the

C. Wrap-up

1. Take the kite outside, and with your back to the wind, allow the wind to lift the kite into the air.

2. Obey all safety precautions and rules for flying kites (see “Kites in the Classroom” presentation at http://www.nationalmuseum.af.mil/shared/media/document/AFD-070523-007.ppt).

3. Make adjustments to the bridle string and tow point as needed. If the kite needs repair or extra reinforcement, do so with strapping tape, as needed.

4. Enjoy the flying experience!

Assessment/ Evaluation:

Students should be evaluated on their ability to follow directions, work cooperatively in groups, and produce quality work. They should also be required to explain in writing how and why a kite flies using Bernoulli’s principle and the four forces of flight. As a math extension, students can be required to find the surface area of the kite. Their blueprint, pattern, and kite should be evaluated as well.

Resources/ References:

Greger, Margaret. *Kites for Everyone.* Winona, Minnesota: Apollo Books, Inc., 1984.

Hosking, Wayne. *Flights of Imagination.* Washington, D.C.: National Science Teachers Association, 1990.

Rowlands, Jim. *The Big Book of Kites.* New York, New York: Dryad Press, LTD., 1988.

Figure A

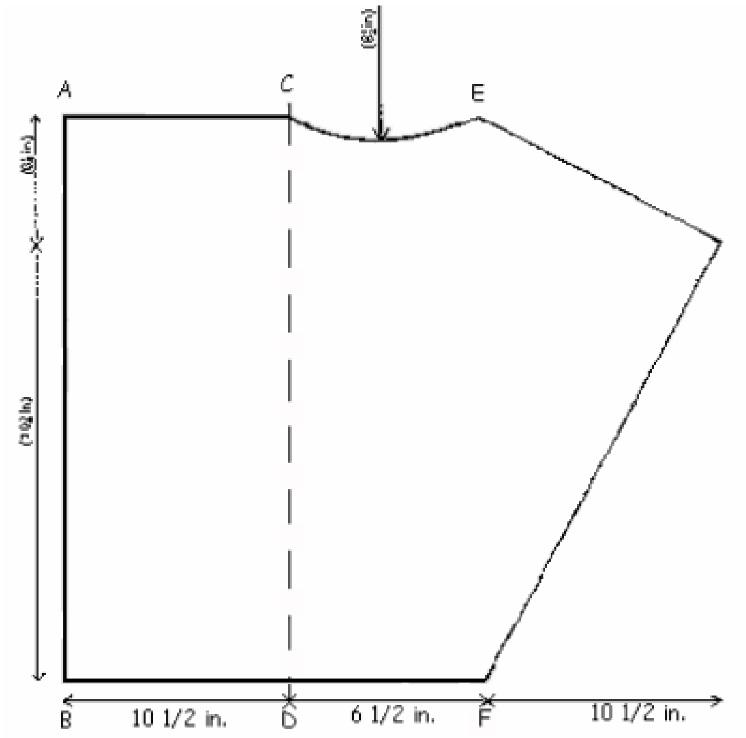

Figure B

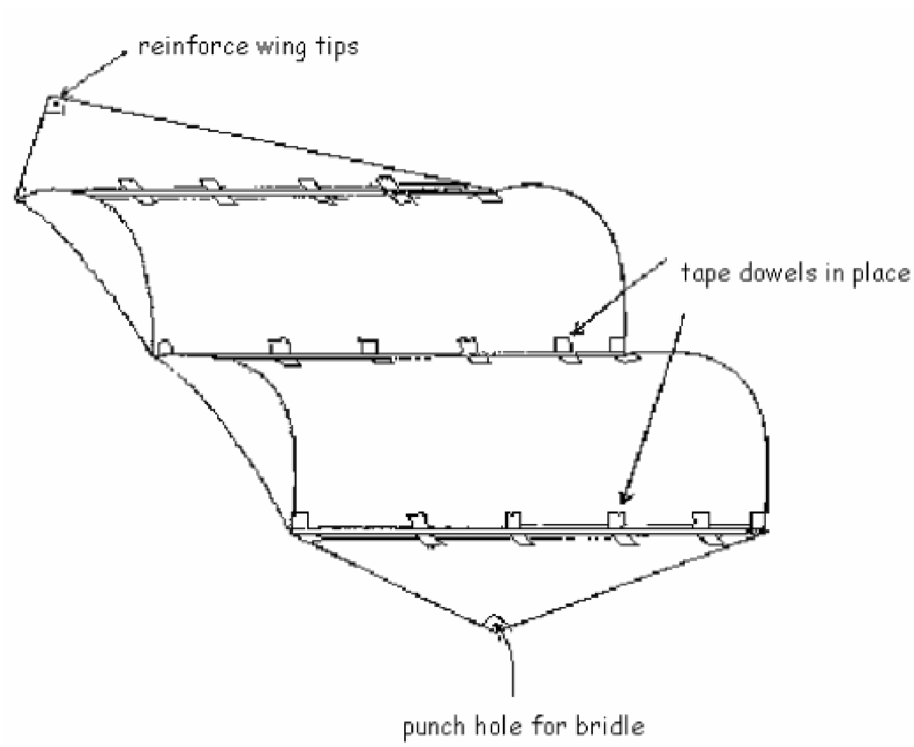

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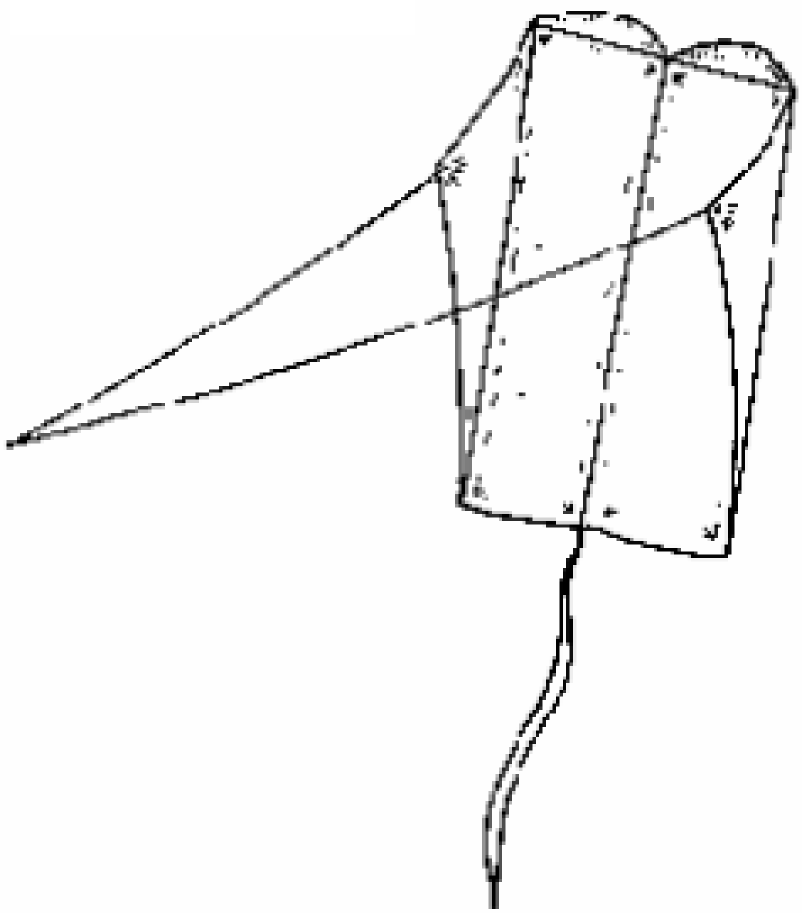
Figure C



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