



Skimmer Car Design Challenge

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Contextual Scenario

In today's competitive economy, companies are always looking for an advantage. No where is this truer than in the automotive industry. Car companies work hard to design the next best car, and to beat out the competition. As such, there is always a need for engineers who understand how to problem-solve, in a real-world way, in order to improve upon existing designs. To do this, engineers must understand how each part works, and how making changes to each of those parts will affect the whole. It is also necessary to understand the final goals of the process; whether that be speed, distance, accuracy, aesthetics, or some other need.

Design Challenge

Your challenge is to construct your own skimmer car with your group that can go a long distance using only the materials you have been provided.

After you and your group construct your car, test the car using the launcher provided to determine how far it will go. Measure the distance your car traveled. Later, you will have several opportunities to construct and alter new cars.

We will have a competition for the best performance car and awards for different design categories

Objective

Students will be able to use the engineering design process to create a skimmer car to demonstrate the science concepts of lift, thrust, drag, and weight. Students will be able to conduct numerous trials in order to improve the distance of their skimmer car.

Standards

Next Generation Science Standards:

3-PS2-1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

3-PS2-2. Make observations and/or measurements of an object's motion to provide evidence that that a pattern can be used to predict future motion.

Disciplinary Core Ideas:

PS2.A: Forces and Motion

- Each force acts on one particular object and has both strength and a direction. (3-PS2-1)

- The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (3-PS2-2)

PS2.B: Types of Interactions

- Objects in contact exert forces on each other. (3-PS2-1)

Science and Engineering Practices:

Asking Questions and Defining Problems: In grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.

- Ask questions that can be investigated based on patterns such as cause and effect relationships. (3-PS2-3)
- Define a simple problem that can be solved through the development of a new or improved object or tool. (3-PS2-4)

Planning and Carrying Out Investigations to Answer Questions or Test Solutions to Problems: In 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3-PS2-1)

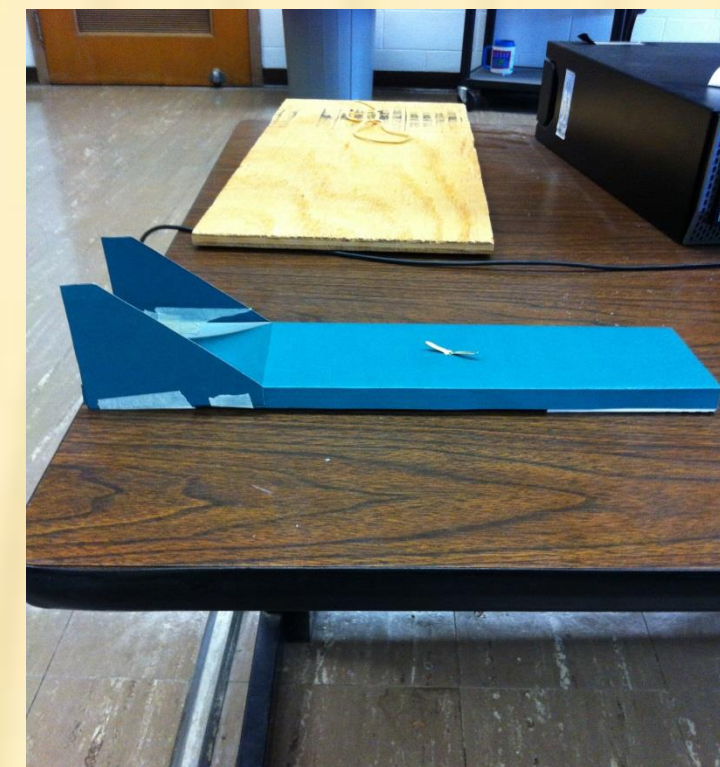
- Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (3-PS2-2)

Materials

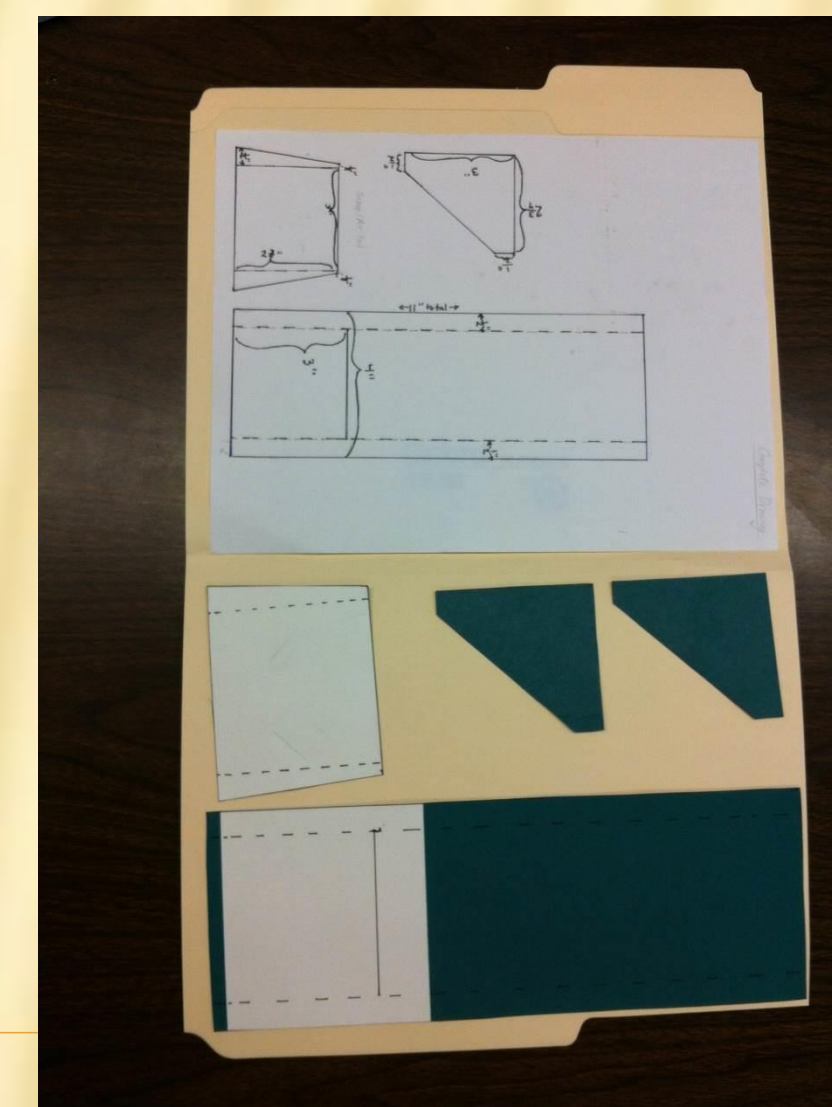
- Card stock (various weights of paper for later trials)
- Brads
- Scissors
- Tape
- Rulers
- Measuring tape
- Rubber bands
- Wooden boards
- Nails
- Hammer
- Pencils
- Charts
- Stopwatch (optional)
- Journals (optional)

Procedures

1. Students will be introduced to a model of a skimmer car. They will discuss the parts and function of the parts. Students will review pre-taught vocabulary of drag, lift, thrust, weight.



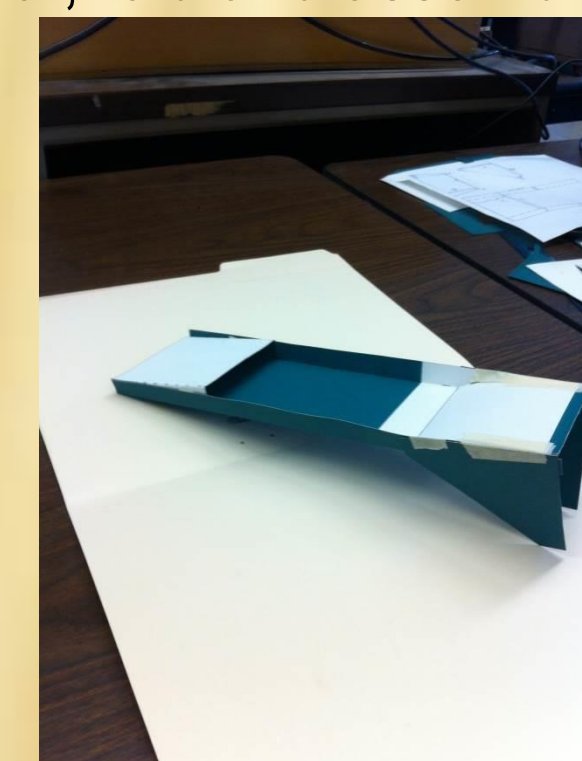
2. Students will be placed in teacher chosen groups. Depending on age and skill level students will either draw and measure plans to scale using a ruler for measurement, or measure pre-drawn plans and record measurements for future alterations. Students will then cut out parts of the car.



3. Students will then cut, fold and assemble their car.



Cut and fold foil; tape to body. Fold foil.



Tape wings and second foil to body



Push brad through body; use tape to secure if needed

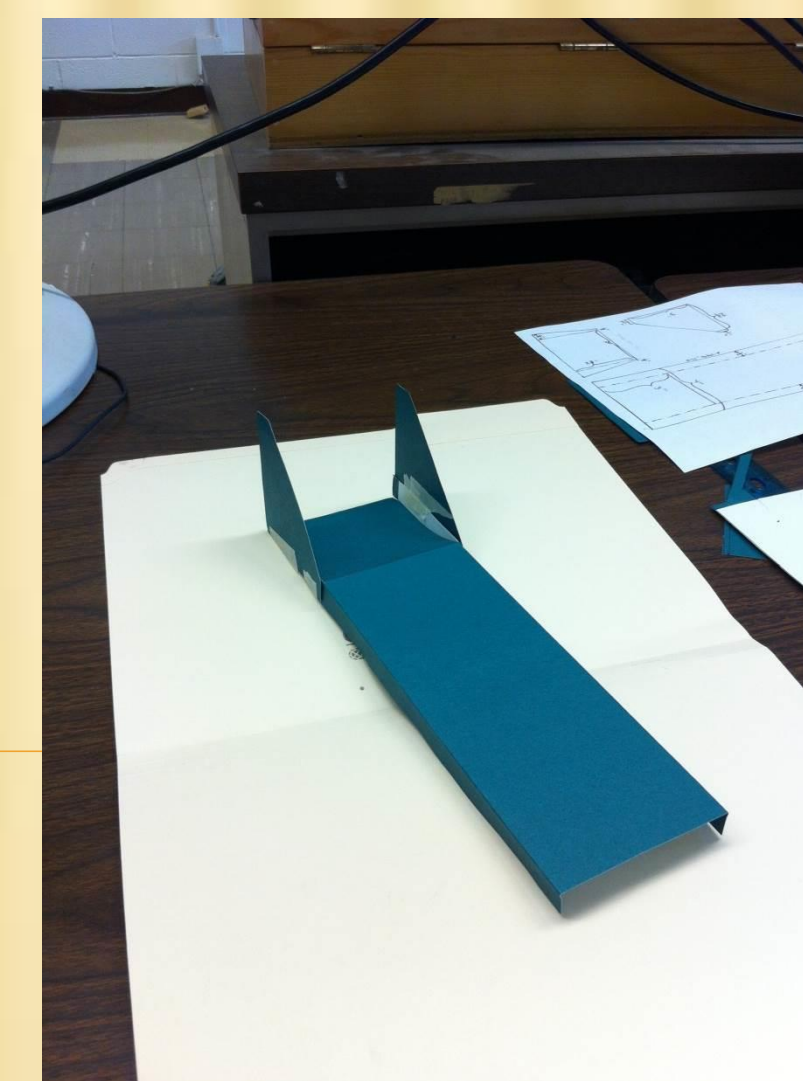
4. Student will use a rubber band attached to a wooden block to "propel" their skimmer cars. Students will then measure and record distance on their chart.



5. Student will compare their car's performance and discuss possible alterations to improve performance.

Skimmer Car Design	Body (Drag/Weight)	Wings (Lift)	Foils (Lift)	Rubber Band (Thrust)	Distance Traveled
A (control car)					
B	x				
C		x			
D			x		
E				x	
F					
G					
H					
I					

6. Students will build a second car changing one key element of the car design. The element changed will be the same for all students as determined by the teacher. Students may change that element in any way they wish as long as the rest of the car remains the same. New distance trials will then be held followed by class whiteboard discussion.



Completed skimmer car with altered body design- body is longer and thinner

7. Students will continue to build models changing one element each time. The first four altered cars will be altered per teacher directions. The last four cars students will have the freedom to choose their alteration, but they still must alter one design element at a time. Each new model will be trialed for distance, recorded and results will be compared and discussed.

Concepts

- The teacher will pre-teach a lesson on measurement. The teacher will teach measuring to the inch, 1/2 inch, 1/4 inch and 1/8 inch to students.
- The teacher will frontload the vocabulary words drag, thrust, weight, and lift. Teacher will use videos, textbooks, and other resources to provide vocabulary instruction. Sample videos may be found in the reference section of this poster.

Strategies

- The teacher should blow up the elementary design process on bigger poster paper, and discuss each step with the children as they go through it. They should discuss why each one is important, and why it is so important to go back and work on improving your invention.
- The teacher should be doing mini lessons within the bigger lesson one on measurement.
- Working with the social studies curriculum teaching the students about the history of the automobile, and learn about local businesses in the area that make automobiles.
- Working on lessons on graphing and charting data that is collected while conducting their many trials.
- In ELA working on journaling results of the trials, and writing a formal letter to local businesses to learn about how an automobile works.

Conclusion

By engaging in this engineering design challenge students will have the experience of applying science and math concepts to an engaging hands on design exploration that results in the completion of a skimmer car model. Students will also have the opportunity to further explore problem solving through repeated alterations and testing of various skimmer car models. Students will use cross curricula skills in ELA and Social Studies to deepen their understanding of Science and Math concepts.

Extensions

- Older students may trial for speed as well as distance using a stop watch
- ELA journaling and prompting may be used to reflect on performance and plans for future alterations
- Possible homework may include sending home a pre-cut skimmer car home with students for them to construct with family members. Cars will be brought back and tested in school
- Skimmer cars will be used in as an activity station for school Community Night where students will teach other students and parents how to engineer and test their car
- Students will exhibit their best skimmer car in school's display case and share science concepts behind their successful cars
- Students will connect their skimmer car learning to the Social Studies curriculum by learning about the history and progression of cars and their ties to Buffalo through the Ford and GM plants.
- Students will send letters to the local Ford and GM plants explaining the science and math behind their skimmer cars.

References

(n.d.). Retrieved from <http://www.nextgenscience.org/>

<http://video.pbs.org/video/1607925512/>

<http://www.sciencekids.co.nz/videos/engineering/flightaerodynamics.html>