STEM Design Challenge developed for : 5th Grade Math Class

STEM Design Challenge Project Title: Gliders

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STEM Design Challenge Project Placement and Pacing

Placement: After review of finding the average (mean) and reviewing measuring in inches.

Pacing: One week – (5 days) 60-minute time periods

Overview: Student teams build the best glider possible; accurately gliding to a determined target.

Objectives:

Math –

- Recording and adding 3 throws (glides) points into Lunar Landing data table
- Finding the average (mean) of the combined 3 throws (glides)

Science –

- Determine most effective glider design
- Analyze design based on thrust, lift, drag and weight
- Modify glider and/or building materials
- Evaluate glider landing accuracy

STEM Design Challenge Problem:

The American Exploration, Inc. company executes remote explorations. Our most dangerous and challenging assignment will be to travel to the moon to collect sand and dirt samples from the moon's largest crater – the South Pole-Aitken basin. These samples will be analyzed in labs for scientific research.

A glider will be attached to a Space Shuttle, which, upon entering the moon's atmosphere, the glider will be released to glide down and into the 1500-mile wide and 5-mile deep crater. Accuracy is essential as this crater is dangerous and extremely rocky.

Student teams will have an opportunity to design this glider.

Materials List:

- Books from library (craters, moon, gliders, flight)
- Straws (50 per class)
- Masking Tape (2 rolls to be shared among all students)
- Paper (2 sheets of copier paper per student team)
- Paperclips (1 box-small size per class)
- Gliders Procedure and Conclusion handout
- A model crater (using butcher paper) that is taped on ground and looks like a giant bulls-eye (center = 5 pts., 2nd tier = 3 pts., 3rd tier = 1 pt.)

Preparation:

1. Check out available books from school library on craters, moon, gliders, and flight. Set out for students on table or counter.
2. For each pair of students, copy one of each:
   - American Exploration, Inc. memo
   - Gliders Procedure and Conclusion handout
3. Read and understand *Engineering Scoop* (in Resources section of this document)
4. Set up materials area. (scissors, rulers, straws, tape, paper)

Procedure:

1. Create partner teams.
2. Distribute American Exploration, Inc. memo to teams. Using document camera or overhead projector, read memo to class.
3. Using document camera or overhead projector, show the Lunar Landing data table (included in Glider Procedure and Conclusion handout) and discuss how the team earning the highest average will be awarded the winning contract.
4. Read together and discuss *Engineering Scoop*. Introduce vocabulary *force, weight, thrust, lift, drag and weight* and discuss their impact on flight.
5. Partner teams research craters, moon, gliders, flight using books from library, and the internet. Students take notes.
   *Brainstorm with the class additional questions that make their research valuable.
6. Distribute Glider Procedure and Conclusion handout. Together, partner teams select a name for their company, and complete the Problem and Prediction section. Successful completion of this is their "ticket" to move to the design phase of the lesson.
7. Partner teams gather building materials (limit of 2 sheets of paper per team).
8. Partner teams begin the design process, testing and revising throughout the process. Students test their gliders by creating their own target and flying their glider to the target. *The model crater (butcher paper) will not be introduced until the test flights.
9. Prior to the test flights, allot a time block to allow partner teams to complete the Procedure section of the Glider Procedure and Conclusion handout.
10. Flight test time. Each partner team will get 1 practice flight, and then will do 3 flights. After each flight, students record score in their Lunar Landing data table. All other students at this time are watching, waiting for their turn.
    *Use a digital camera to take pictures of the process for a Gliders bulletin board!
11. Finally, students finish the Conclusion and Lunar Landing data table sections of Glider Procedure and Conclusion handout. The handout is submitted to the teacher for review. After all handouts are turned in, and accuracy is checked in the teams' Lunar Landing data tables, a winning team is awarded the contract to build the moon glider.

Resources:

- Books
- Websites

http://science.howstuffworks.com/transport/flight/modern/glider.html

http://www.mansfield.org/Schools/MMS/staff/hand/flightglider.htm
http://www.ehow.com/how-does_4606003_gliders-work.html

- ***Engineering Scoop:***

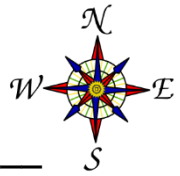
If you throw a **plain straw**, it doesn't go very far. But when you add **paper hoops**, the straw glides through the air. That's because the hoops act like **wings**. Things that **fly**- like insects, birds, and airplanes- all have wings. But wings are not all the same **shape** and **size**. Different wings can be better for different kinds of flight. For example, an eagle has **long, wide wings** that help it glide. An airplane has **wings with small flaps** that move up and down to turn the plane. Try **changing** the wings on your glider. How does it **fly** with different wings?

THRUST: The physical force that propels the aircraft from take-off to flight.
LIFT: This is the force generated by the movement of air across the surface of the wing.
DRAG: As the opposite force of thrust, drag acts to slow the aircraft down.
WEIGHT: The gravitational pull of the earth, weight, is the opposite of lift.
FORCE: The push or pull on an object.

Evidence:

- Glider Procedure and Conclusion

Gliders



Company Name: _____

Name: _____ **Name:** _____

PROBLEM:

_____

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PREDICTION: (How accurate do you think you can make a glider? How far do you think it can go? What materials do you think will help you?)

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PROCEDURE: (What steps did you take to make your glider? How did you redesign it? What materials did you use? Why?)

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LUNAR LANDING

1st Throw:	
2nd Throw:	
3rd Throw:	
Total:	**Show Work**
Average:	

CONCLUSION: (What design worked best for your company? What materials worked well? What materials did not help you? What was your best throw?)

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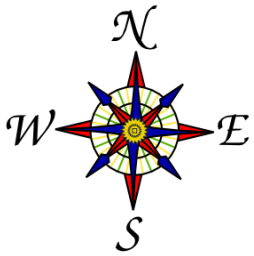
AMERICAN EXPLORATION, INC.



Memo

To: Finley Elementary 5th Grade Design Teams

From: AMERICAN EXPLORATION, INC.

Date: _____

Subject: Exploring the Moon

The American Exploration, Inc. company executes explorations to remote locations. We send our astronauts to explore and bring back specimens to be analyzed in our labs. Our most dangerous and challenging assignment will be to travel to the moon.

The moon has a vast amount of craters than can be very deep and rocky. The largest crater is called the South Pole-Aitken basin. Our team of astronauts has completed training, and is ready to descend into this crater and explore.

A glider will be attached to a Space Shuttle. Upon entering the moon's atmosphere, the glider will be released to glide down and into the 1500-mile wide and 5-mile deep crater. Accuracy is essential as this crater is dangerous and extremely rocky.

We need a vehicle that can glide down into the bottom of the crater and land safely. After landing, our astronauts will move from the glider exploring, collecting rocks, sand and other particles to be analyzed by our laboratories. We need a gliding system that is precise and accurate.

Your challenge is to design this gliding vehicle. The gliding system that comes closest to the target during demonstrations will win the contract and be installed on our space vehicles.

Thank You and may the best team win….

CEO of AMERICAN EXPLORATION, INC.

Matt Smith