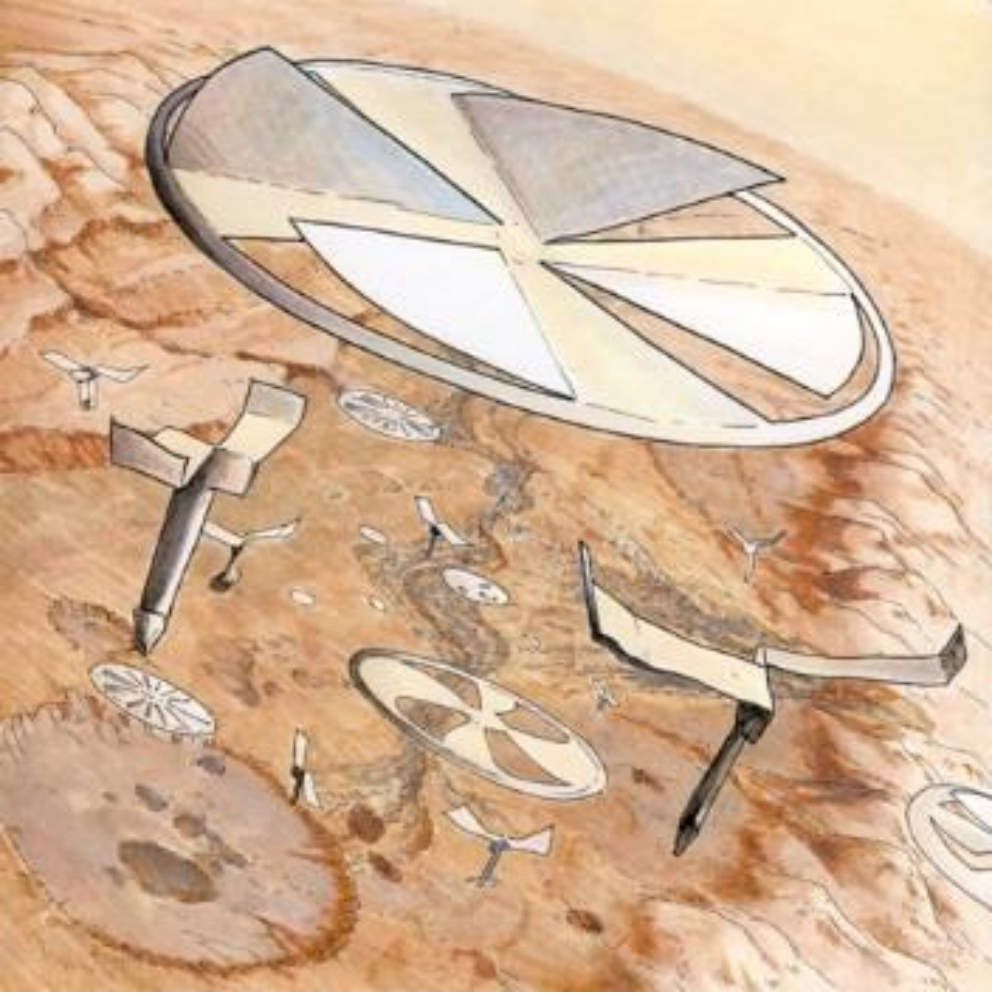


Engineering is Elementary

Using NGSS Science and Engineering Practices to Boost Program Quality and Youth Outcomes

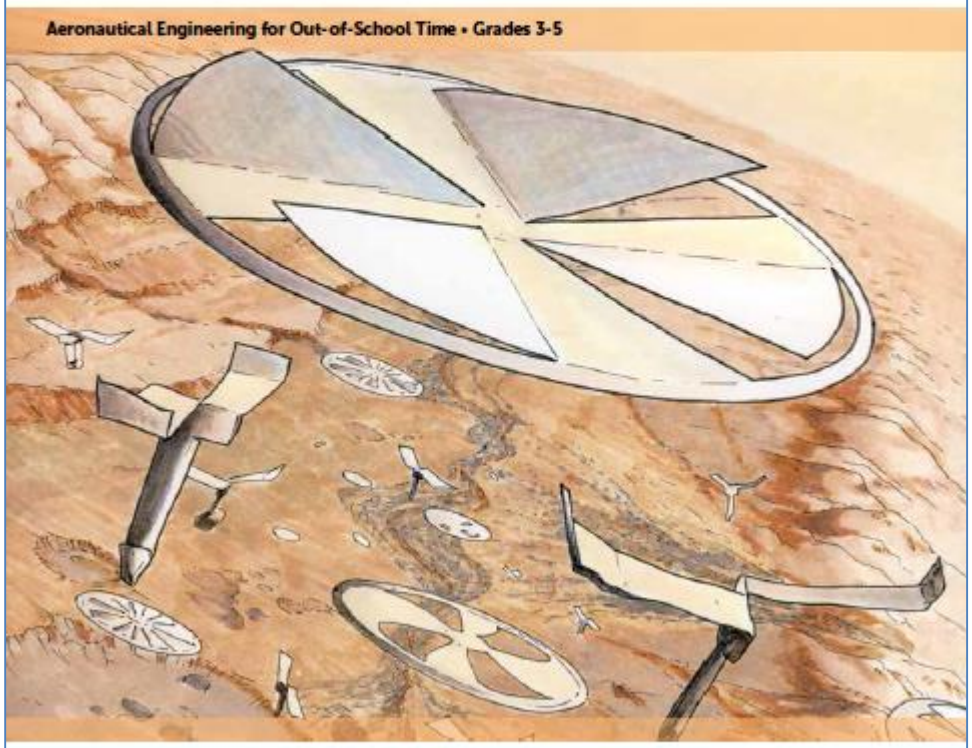
Agenda

- Participate in a science and engineering activity
- Review NGSS as it relates to Power Skills
- Discuss how NGSS and Power Skills appeared in the activity
- Watch a video and reflect
- Think about how you would coach our video educator
- Share some trainer resources

Engineering Adventures℠

The Sky's the Limit: Engineering Flying Technologies

Aeronautical Engineering for Out-of-School Time • Grades 3-5



Written by the Engineering is Elementary® Team
Illustrated by Ross Sullivan Wiley and the Engineering is Elementary® Team

EiE Engineering is Elementary | Engineering Adventures
Developed by the Museum of Science, Boston

Reply | Forward | Archive | Delete

from:	engineeringadventures@mos.org
to:	You
subject:	Stop, Drop, and Spin! 9:18 AM

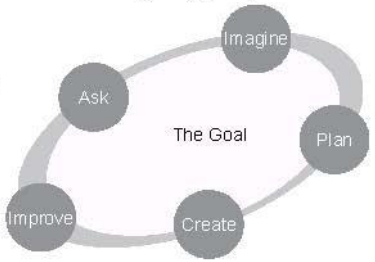
Hello engineers!

India and I had a great time testing materials in the vertical wind tunnel. We learned a lot about how objects react in an updraft of wind.

This got us wondering about what would happen if there isn't a lot of air moving. How could a technology hover or fly over an area without strong wind pushing against it? April explained that all flying technologies rely on the air around us. Some technologies, like drop copters, are designed so that air pushes against them as they fall. Drop copters spin like helicopters when you drop them. As they fall, air pushes against their blades and slows them down. The more slowly they fall and spin, the more photos we would be able to take for April before they hit the ground.

Speaking of the ground, we still don't know what part of the world we'll be helping to take pictures of. April did give us one hint. She said we'll be on the sand, but not at the beach. Do you have any guesses?

The criteria for your drop copter designs is that they should fall as slowly as possible. India and I sent you some templates you may want to try, but we know you'll be able to use the Engineering Design Process to *imagine*, *plan*, and *create* drop copters that fall even more slowly than our examples! Try playing around with different materials, shapes, numbers of blades, and even adding paper clips as weights. We can't wait to hear how it goes!



Jacob

Activity

Investigate

Test different dropcopters.

Activity

Reflect

What variables did you test? What observations did you make about how different variables impacted the rate at which the dropcopters fell?

Activity Introduction

- **Design Challenge:** Engineer a flying technology that meets certain criteria.

Reply | Forward | Archive | Delete

from:	engineeringadventures@mos.org
to:	You
subject:	Creating Your Own Flying Technology 4:05 PM

Hi engineers,

Jacob and I have arrived! The name Empty Quarter doesn't begin to describe what it's like here. Imagine the biggest, hottest, sandiest area you've ever been to. Now imagine that a million times bigger, hotter, and sandier! The wind makes beautiful patterns in the sand and you can see for miles and miles.

Our mission is to take aerial photos of this huge desert with many weather patterns, so Jacob and I thought we better break this into smaller challenges. On a map, we blocked off different areas of the Empty Quarter. We're going to engineer models of different technologies that could fly above each area we marked off. Models are representations of something. It can be really smart with a big project like this to make a smaller model technology first to make sure it works well. Then, April and her crew will make the full-sized version.

You have learned so much about different aeronautical technologies, Jacob and I know you will be able to help us. But, before I sign off there's just one more, tiny, little hitch. Apparently there's a big sandstorm brewing. It's creating some wind patterns that you might need to think about when designing your technologies. Don't worry, though. Jacob and I will keep you posted!

So, take a look at the map Jacob and I marked off and choose which area you would like to photograph. Engineer a technology that will meet the criteria and constraints for flying in the area that you've chosen. Use the Engineering Design Process to help you. Good luck!

Talk to you soon,
India

Activity:

Design Your Flying Technology

Your goal is to design a flying technology that meets the following criteria and constraints.

Criteria:

- Carry at least two photographers
- Stay in the air for at least two seconds

Constraints:

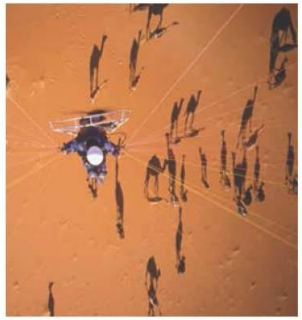
- Your technology cannot use more than 8 materials.

Activity

Plan & Create

Adventure 4 **Aerial Photographers**

A team from National Geographic has sent photographers to the Empty Quarter. Just like with our challenge, they needed to get their photographers high up into the air to take pictures. Here are some pictures of their adventures.



Remember, the higher your aerial photographer and the slower your flying technology falls, the more pictures you'll be able to take.

photos from: http://ngm.nationalgeographic.com/ngm/0502/feature1/multimedia/multimedia.html

Activity

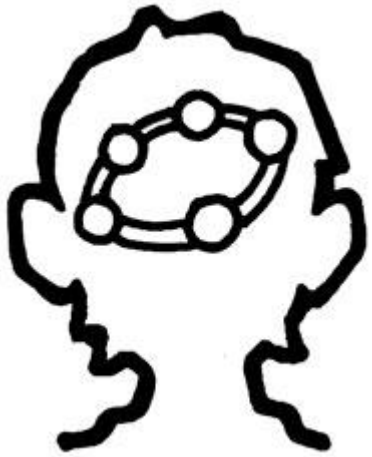
Plan & Create

Work in your group to engineer a flying technology that meets the criteria and constraints.

Activity

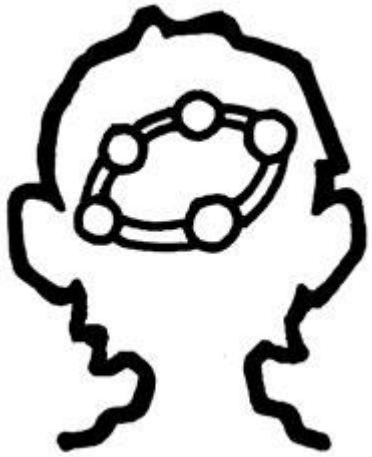
Engineering Showcase

- Tell us about your design.
- What would you improve if you had more time?



Debrief

- How would you describe the way we facilitated the activity?
- What are some strategies that we used?



Power Skills

- Perseverance (Drive)
- Relationships (Collaboration/Teamwork)
- Critical Thinking
- Self-Regulation (Respect/Awareness of Self & Others)

Next Generation Science Standards

There are three main parts of the NGSS:

- Practices
- Cross-Cutting Concepts
- Performance Expectations

Next Generation Science Standards

Practices (skills)

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Next Generation Science Standards

Cross cutting concepts

1. Patterns
2. Cause and effect
3. Scale, proportion, and quantity
4. Systems and system models
5. Energy and matter
6. Structure and function
7. Stability and change

Next Generation Science Standards

Performance expectations (points of knowledge)

Life Science, Earth and Space Science, Engineering Design

MS-ETS1-3: Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ESS1-3: Analyze and interpret data to determine scale properties of objects in the solar system.

Next Generation Science Standards

Together, Practices, Cross-cutting concepts, and Performance expectations make up three-dimensional learning!

Next Generation Science Standards

Practices (skills)

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

NGSS and Power Skills

Reflect:

How do you think the Power Skills and the Practices relate? Is there crossover? Are there unique components?

Power Skills & Practices

Perseverance	Relationships	Critical Thinking	Self-Regulation

Power Skills & Practices

Perseverance	Relationships	Critical Thinking	Self-Regulation
Asking questions (for science) and defining problems (for engineering)	Constructing explanations (for science) and designing solutions (for engineering)	Developing and using models	Engaging in argument from evidence
	Obtaining, evaluating, and communicating information	Planning and carrying out investigations	
	Engaging in argument from evidence	Analyzing and interpreting data	
		Using mathematics and computational thinking	

Video of this Activity

http://www.eie.org/engineering-adventures/professional-development-video-resources

Reflect on the video

- What NGSS practices and Power Skills did we see here?
- What types of questions did the educator ask?
- Would you coach her/offer her any suggestions for future lesson planning?

PD Guide

- http://www.eie.org/engineering-adventures/lead-your-own-engineering-adventures-workshop
- And other resources! eie.org

Questions?

Contact Us!

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