NASA, WGBH: Designed to Inspire: On the Moon

Presented by: Kristy Hill, Natalie Hebshie, Susan Buckey and Thea Sahr

Thursday, June 4, 2009
On the Moon Web Seminar

NASA and Design Squad: Team up to inspire a new generation of engineers
Introductions

Susan Buckey (WGBH)

Kristy Hill (NASA)

Thea Sahr (WGBH)

Natalie Hebshie (WGBH)
Tell us about you!

Which of the following is your primary subject area?

A. Earth/Space Science
B. Biology/Life Science
C. Physical Science/Technology
D. Integrated/General
Do you use engineering activities in your classroom?

A. Not at all
B. A little bit
C. Regularly
AGENDA

- NASA, *Design Squad*, and the Partnership
- The *On The Moon* Guide
- Engineering and the Design Process in the Classroom
- Talking to Kids about Engineering
- More Resources from *Design Squad & NASA*
- Q & A, Next steps
NASA and Design Squad
NASA and Design Squad partner to:

• support kids hands-on learning of engineering
• inspire the next generation of engineers
• improve the public image of engineering
• deliver hands-on activity resources to educators
• offer online training on the design process to educators
• NASA explores questions like:
  What’s out there?
  How do we get there?
  What will we find?
  How will what we learn improve life on Earth?

• Employs over 90,000 engineers

• Goal for 2020: Return to the moon and build a lunar outpost for astronauts
Lunar Reconnaissance Orbiter (LRO)

- unmanned spacecraft
- select safe landing sites
- study radiation levels on the moon
- identify lunar resources to support life and the building of the outpost
Lunar Crater Observation and Sensing Satellite (LCROSS)

- search for ice and minerals to support life on the moon
- look in shadowed craters near moon’s poles
- hurl 2 sections at the moon and the Hubble telescope will analyze dust plume
Are you familiar with Design Squad?

A. Yes, I’ve seen the show.
B. Yes, I’ve visited the Web site.
C. Yes, I’ve seen BOTH the Web site and the show.
D. No, I know very little about Design Squad.
DESIGN SQUAD

13 episodes · 1 host · 8 contestants

Two teams · One challenge

One winner · $10,000 scholarship from Intel

Web site · 35 hands-on activities
After viewing four Design Squad episodes:

• students’ understanding of the Design Process increased.
• their stereotypes of engineers were broken.
• they wanted to enroll in an engineering afterschool program.
• they understood the science content on the shows.
• they had a better sense of teamwork.
• AND they liked it!

Goodman Research Group, Inc.  October 2007
The
On the Moon
Guide
Answer Yes √ or No X from above the participant list.

Have you seen a copy of the On the Moon Guide?
A resource that brings NASA’s lunar missions to life - for you and your kids.

Includes:
• leader notes
• open-ended questions
• extension activities
• curriculum connections
• NASA background
Activities are aligned with:

- National Science Standards
- International Technology Education Association (ITEA) Content Standards
- Massachusetts Science and Technology/Engineering Standards
Every aspect of *Design Squad* reinforces the design process.

Use it with kids to:

- expand their thinking
- become more innovative
- learn from their mistakes
DESIGN PROCESS

How design challenges enhance student learning:

• Give hands-on applications of science concepts
• Develop an experiential basis for classroom learning
• Integrate a wide variety of curricular topics
• Promote interdisciplinary thinking
• Put science concepts in a relevant context
Have you taught the Design Process to your students?

A. Not at all
B. A little bit
C. Regularly
Challenge
Design a rocket that can consistently hit a target.

Build
Create basic rocket.
Add balloon launcher.

Test
Launch your rocket.

Redesign
Does it launch on command?
Could it be more reliable?
Challenge
Design and build a system that will protect two “astronauts” when they land.

Build
Build shock-absorbers that will protect them upon impact.

Test
Use it repeatedly.

Redesign
What changes did you make?
What did you learn from others?
Challenge
Design and build an ATV that can handle the moon’s rugged terrain!

Build
Build the rover so that it is powered by the band and rolls with square wheels.

Test
Does it work consistently?

Redesign
Do the wheels turn freely? Does it travel in a straight line?
Challenge
Design and build a crane and see how heavy a load it can lift

Build
Build an arm and reel that can lift a cup attached by a hook.

Test
Try it with increasingly heavy loads.

Redesign
Is the arm attached securely to the base? Does the take up reel work consistently?
Challenge
Modify a paper cup so it can zip down a line and drop a marble onto a target.

Build
Build a zip line and a system to drop the marble on a specific target.

Test
Does it work consistently?

Redesign
Does the cup move smoothly on the line? Does the marble release when you want it to?
Challenge
Design and build a solar hot water heater

Build
Build a system that will heat water flowing slowly through a tube.

Test
Take temperature measurements before and after you test.

Redesign
What changes could you make to heat the water more? Is the water flowing too quickly?
### ON THE MOON

#### Challenge Events Grades 3-5 Grades 6-8 Grades 9-12

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<thead>
<tr>
<th>Challenge</th>
<th>Events</th>
<th>Grades 3-5</th>
<th>Grades 6-8</th>
<th>Grades 9-12</th>
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<tr>
<td>Launch It</td>
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<td>Touchdown</td>
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<td>Heavy Lifting</td>
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<tr>
<td>Feel the Heat</td>
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[www.nasa.gov/education/moonguide](http://www.nasa.gov/education/moonguide) or [pbs.org/designsquadd/parentseducators](http://pbs.org/designsquadd/parentseducators)
Which activities are you most likely to integrate into your curriculum?

<table>
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Talking to Kids About Engineering
• Highschoolers have no idea what they do.

• Think they work alone in a cube all day doing math problems
Engineers dream up creative, practical solutions and work with other smart, inspiring people to invent, design, and create things that matter. They are changing the world all the time.
WHAT DO ENGINEERS DO AT WORK?

• Think creatively.
• Work with great people.
• Explore possibilities.
• Change the world and make a difference.
Let’s Pause for Questions
More Resources from Design Squad and NASA
FREE RESOURCES

Educator’s Guide
4 Units, 10 Activities
(Classroom)

Event Guide
5 Activities (Events)

Activity Guide
5 Activities
(Classroom or Events)

Invent It, Build It - NEW!
In English and Spanish
6 Activities
(Classroom or Events)
RESOURCES

- 10 Activities
- 4 Units
- Leader Notes
- Reproducible Handouts
- Linked to ITEA Standards
RECOMMENDED ACTIVITY

CHALLENGE 7: DANCE PAD MANIA

YOUR CHALLENGE
Build a dance pad that lets you use your feet to control a buzzer or flash a light.

MATERIALS
- 1 9-volt AA battery
- Adhesive tape
- Aluminum foil
- Alligator clips
- Rubber bands for light (enough for half the group)
- Scrap wood
- White glue
- Electric wire (20 gauge works well)
- Non-conductive foam

BRAINSTORM AND DESIGN
Divide your group into teams of two. Half the teams will make Buzz pads that flash a light, and the other half will make Click pads that sound a buzzer. When you work as a team, you can offer each other design challenges to solve. For example, you can share knowledge, get new ideas, and brainstorm solutions to problems. You can also learn new skills by watching how other teams make their pads and seeing how they solve problems.

Your dance pad is basically a specialized version of the drum you built in Challenge 1. Like Hidden Ameba, the dance pad has a power source (the battery), materials for conducting electricity (the wood and foil), and something that causes the electricity (the buzzer or light). But that's right, it's an electrical circuit. Before you begin designing, brainstorm answers to the following questions and record your ideas in your design notebook:

- Will my pad turn on with a touch or a light?
- How will I build a switch that requires me to touch the pad or light on and off?
- How will I build a light that switches on and off?
- How can I make it strong enough to withstand constant stepping?
- Where will I put the battery? Inside the pad? Outside the pad?

BUILD, TEST, AND REDESIGN
As you build, make sure your circuit works and that it is able to hold up to some rugged treatment! Once you've built your pad, test it. Drop it on the floor to see if you can turn the buzzer or light on and off. How well does it work? When we tested ours, we had to deal with some problems. For example, our Buzz sometimes got loose and our pad stopped working. How can we fix this? We have to fix it so the pad works every time.
After using the Educator’s Guide:

• program leaders found it useful and wanted to use it again.

• they felt more comfortable talking about engineering.

• they developed a better understanding of the Design Process.

• students’ understanding of engineering and science concepts improved.

• AND students liked the engineering activities!

Goodman Research Group, Inc.  October 2007
RESOURCES

• 5 Activities
• Suggestions for running an event
• Reproducible handouts
• Tip sheet for volunteers
• Reproducible signs on Web site
• Linked to ITEA Standards
RECOMMENDED ACTIVITY

POPFLY
YOUR CHALLENGE

It's football with a twist. Invent a way to send a Ping Pong ball flying high enough to catch it. Take some plastic straws, a wooden spoon, and tape. Now, add your feet. Ready, set, launch!

MATERIALS
- Duct tape
- 3-5 paint straws
- 1 wooden spoon
- 5-6 paper cups (for your redesign)

BRAINSTORM AND DESIGN
Using the materials (and your feet), make something that launches a ball high enough so you can catch it. When we made ours, we came up with lots of ways to send our ball flying. Most of our designs (but not all) used levers. Levers are handy because they can convert a small motion (the flick of your foot) into a large motion (the end of the lever flipping your Ping Pong ball into the air). Now, let your imagination (and Ping Pong ball) fly high.

BUILD
Think of different ways to put it all together and get that ball flying!

TEST
How high did it go? Did it fly high and straight enough for you to catch? Could your tallest friend catch it?

REDESIGN
Even the best inventions can be improved. Now that your ball can fly through the air with the greatest of ease, challenge yourself to:
- Send the ball twice as high
- Pop up a tennis ball
- Pop up two balls at once
- Launch a ball for a partner to catch
RESOURCES

- 5 Activities
- Leader Notes
- Reproducible Handouts
- Linked to ITEA Standards
RECOMMENDED ACTIVITY

ZIP LINE

YOUR CHALLENGE
Design and build something that can carry a Ping-Pong ball from the top of a zip line string to the bottom in four seconds (or less).

BRAINSTORM & DESIGN
Look at your materials and think about the questions below. Then sketch your ideas on a piece of paper or in your design notebook.
1. Using those materials, what can you design that can carry a Ping-Pong ball down a zip line?
2. How will your Ping-Pong ball carrier stay on the zip line as it goes from the top to the bottom?
3. What kinds of materials should be in contact with the zip line so that the carrier slides quickly?

BUILD, TEST, EVALUATE & REDESIGN
Use the materials to build your Ping-Pong ball carrier. Then make a zip line. Run the line between the back of a chair and a stack of books. Make sure the high end is about two feet above the low end. Test the carrier by putting it on the line. When you test, your design may not work as planned. The design process is all about “If at first you don’t succeed, then try try again.” On Design Squad we say, “Fall flat—succeeded somehow!” Study the problems and then redesign. For example, if your Ping-Pong ball carrier:
- Needs dropping the ball—Check that it has a BayouMath plan to hold the ball.
- Needs pynamo down—Make sure there’s nothing blocking your carrier where it touches the line.
- Doesn’t balance well—Adjust the weights. Add weights or move them so they are farther below the zip line. Giving this changes the carrier’s center of gravity, the point within an object where all parts are in balance with one another. See how changing the numbers and positions of weights affects the carrier’s balance.
- Takes longer than four seconds to travel the zip line—Find ways to reduce friction. Use, there’s friction, it’s the force that makes friction—every time you’re dealing with something as smooth as rolling dime. You’ll find friction anywhere. Things rub together experiment with different materials to see if you can reduce friction and speed up the Ping-Pong ball carrier.
RESOURCES

- 5 Activities for kids ages 9-12
- Leader Notes
- Reproducible Handouts
- Linked to ITEA Standards
- Available in English and Spanish
RECOMMENDED ACTIVITY

HARMLESS HOLDER

MATERIALS

Here are the materials for today's project. What can you use to build your own holder? (OK, see the pictures.)

GET THE IDEA!
Let’s Pause for Questions
DESIGN SQUAD WEB TOUR

pbs.org/designsqaud
Online Training from NASA and Design Squad

Learn how to integrate the design process into the projects you do with kids with this online training:

- Experience the design process in action.
- Watch an activity, from start to finish.

Coming June 2009!
Coming Fall 2009!

Teacher’s Guide

• For middle school science & technology teachers

• 3 units focused on physical sciences:
  • Electricity
  • Sound
  • Newton’s Laws & Buoyancy

• Linked to National Standards
How familiar are you with the NASA Educator’s Web site?

A. I know it like the back of my hand.
B. I know where to look for what I need.
C. I’m still learning about the site.
D. I don’t know it well at all.
http://www.nasa.gov/audience/foreducators/index.html
Q and A

Next Steps
Go Online:
• www.nasa.gov/education/moonguide
• pbs.org/designsquadt/parentsseducators

Request FREE Print Copies:
E-mail designsquad_feedback@wgbh.org and include:
• a list of guides you would like to receive
• your mailing address (work or home)
Thank you!

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Welcome to Your Professional Development

The Learning Center is NSTA's e-professional development portal to help you address your classroom needs and busy schedule. You can gain access to more than 3,300 different resources that cater to your preference for learning. Over 325 resources, such as journal articles, science objects and web seminars are available for free. A suite of practical tools such as My Library, My Transcript, and My Professional Development Plan and Portfolio that help you organize, personalize, and document your growth over time. It is desired, you may review an archived Web Seminar overview of the NSTA Learning Center, or download the "How to Guide" PDF (2.7 MB).

Explore Learning Opportunities

- By Subject
  - Earth & Space Science
  - Life Science
  - Physical Science

- By Grade Level
  - Elementary
  - Middle School
  - High School
  - College

- By State Standards

- Do-It-Yourself Learning

- Live Online Seminars & Classes

http://learningcenter.nsta.org
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