NES: Problem Solving: Transportation and Space—Reuse and Recycle

 Presented by: Marti Phipps

July 25, 2012
PROBLEM SOLVING: TRANSPORATION AND SPACE

REUSE AND RECYCLE

HOSTED BY:

MARTI PHIPPS

NASA EXPLORER SCHOOLS

Jet Propulsion Laboratory
Astronaut Alvin Drew
Habitat System Project Team
Reuse and Recycle

Grades 10–12
Curricula:
– Technology Education
– Pre-Engineering
National Standards
Technology

- Cultural, social, economic, and political effects
- Environmental effects
- Information/communication technologies
- Transportation technologies
National Standards Mathematics

- Computation and estimation
- Mathematical models
- Measurable attributes
- Units and scales
• Nature of technology and science

– New technologies and technology problems spark a demand for new scientific knowledge
The Activities

• Introduction to Space Resources
• Commercialization of Space
• Reuse and Recycle Man-Made Resources
Student Assessment

- Quiz (Unit Pre/Post Test)
- Rubric for Group Work
- Rubric for Research/Analysis
- Assessment Totals
Educator Guide


http://explorerschools.nasa.gov
Materials

- Computer with Internet access
- Pencil, paper, worksheets

Optional:
- Tools and materials typically found in a technology education lab, including modeling materials such as wood, acrylic, metal, cardboard, glue, mechanical fasteners, electrical components, plastic tubing, spray paint, etc.
Big Idea

Man-made objects, abandoned in space, can become valuable resources.
Conestoga Wagon
Key Terms

- Commercialization
- Profit Margin
- Recycle
- Reuse
- Space Resources
QUESTIONS?
Activity 1

Introduction to Space Resources
Protecting Historic Artifacts


Conestoga Wagon

The most successful human exploration efforts on Earth have always required that explorers “live off the land.”
Research

What kinds of material were discarded?
What are some examples of equipment that has been discarded and where they might be located?
Orbital Debris
Orbital Debris
Orbital Debris
Orbital Debris
Exploration

In the past, explorers found it easier to “live off the land.” This allowed them to travel in smaller, lighter vehicles.
Assignment

Working with a partner, students will research the natural and man-made resources that may be available on the lunar surface and determine whether human necessities for survival are contained in these resources.
Influences

• Technological development
  – Profit motive and the market

• Transportation systems
  – Governmental regulations

• Science and invention
  – Societal influences

• Planetary business
  – Environmental influences
What are some examples of space resources that your students may want to keep in mind as they are researching?
Examples of Space Resources

- Rocket/satellite parts
- Discarded equipment left behind
- Lack of pressure/vacuum
- Temperature extremes
- Magnetic fields
- Gravitational fields
- Microgravity environment
- Rocks
- Minerals
- Etc.
Student Activity

Part 1
List as many resources as you and your partner can think of that exist in space.

List as many resources as you and your partner can think of that exist on the Moon.

List as many resources as you and your partner can think of that exist on other bodies in the solar system.

Part 2
List those items you believe are the most plentiful on the Moon. Indicate whether you believe there is just enough to support a business.
QUESTIONS?
Activity 2

Commercialization of Space
Big Idea

Business in Space:

• satisfy explorers’ needs
• realize a profit
Trade-offs

• Positive and negative effects of products and services
• Some technological problems need new scientific knowledge
• Government regulations influence business operations
Locate pictures of the Russian Luna spacecraft that landed on the Moon in the 1960s. List the parts that could be salvaged by lunar colonists.

Locate pictures of the American Ranger spacecraft that landed on the Moon in the 1960s. List the parts that could be salvaged by lunar colonists.

Locate pictures of the Apollo landing sites, spacecraft, and experiments packages that landed on the Moon in the 1960s and 1970s. List the parts that could be salvaged by lunar colonists.

Locate pictures of the other spacecraft that landed on the Moon since the 1960s. List the parts that could be salvaged by lunar colonists.
Exploration

- Examine lists of available resources from Activity 1
- Explore inventions and innovations needed to make use of resources available on the planet
QUESTIONS?
Activity 3

Reuse and Recycle Man-Made Resources
Decision Making Process

1. Identify Problem
2. Establish Criteria
3. List Alternatives
4. Weigh Alternatives
5. Select Alternative (Decision)
6. Weigh Decision
7. Evaluate Decision
8. Implement Decision

Decision making process flowchart.
Big Idea

Man-made objects abandoned in space can become valuable resources for future space exploration.
Activity 3.1

Using a two-liter soda bottle:

- Compare bottle with fuel tanks on the Altair Lunar Lander.
- Estimate the length and diameter of the tanks and calculate the volume of one tank.
- Can assume the tanks have flat ends as opposed to spherical ends.
John Connolly on Altair

Destinations Lead for Human Exploration Architecture Team
Altair Lunar Lander

Compare soda bottle with fuel tanks

Estimate length and diameter of tanks

Calculate the volume of the tanks
Volume

Sphere
\[ v = \frac{\pi d^3}{6} \]

Cube
\[ v = a^3 \]

Cylinder
\[ v = \frac{\pi d^2 h}{4} \]

Volume is the three-dimensional space occupied by an object.
Activity 3.2

Develop a business plan using existing natural and man-made resources.
American Ranger
Saturn Rocket
Chat Quiz

• How many Apollo missions were there in all…starting with Apollo 1?
Chat Quiz

• How many Apollo missions were there in all...starting with Apollo 1?
• What was the first Apollo mission to actually land on the moon?
Chat Quiz

• How many Apollo missions were there in all…starting with Apollo 1?
• What was the first Apollo mission to actually land on the moon?
• How many Apollo missions actually touched down on the lunar surface?
Chat Quiz

• How many Apollo missions were there in all...starting with Apollo 1?
• What was the first Apollo mission to actually land on the moon?
• How many Apollo missions actually touched down on the lunar surface?
• Extra credit question:
  Name the 3 astronauts of Apollo 11.
Apollo
Lunar Rover
Criteria

Identify and disassemble man-made resources left on the lunar surface
Alternatives

Determine what new resources to manufacture from natural and man-made resources
Alternatives

Determine what type of business you hope to create
Implementation

Develop a business and profit plan
In Situ Resource Utilization Design Challenge
Situation

You will soon be moving to the new Lunar Colony. The colony only lets people move there if they have a business plan to support themselves and their families.
Challenge

Working with your business partner, you develop a plan to use the Moon’s natural resources and reuse man-made resources on the Moon to help lower costs.
Criteria and Constraints

It is generally accepted that all man-made debris on the lunar surface belongs to the country that launched it. In order to use it, an entrepreneur colonist must ask permission from the owner.
Criteria

• Plan must include visuals, such as charts, graphs, drawings, 3-D models, and PowerPoint® slides.
• Plan must realize a profit.
• A preliminary proposal must be completed in five days.
Procedure

• Research different lunar resources, natural and man-made.
• Decide what type of business you will start.
• Research required inventions and innovations.
• Determine what will be needed for your business. (Write your request to the owner of the hardware you wish to use.)
Procedure, Continued

- Develop charts, graphs, drawings, PowerPoint® slides, etc.
- Design and build a scale model of your business (at the lunar colony).
- Present your plan to the class.
QUESTIONS?
Build a Moon Habitat

http://spaceplace.nasa.gov/moon-habitat/
http://www.scienceinschool.org/2011/issue19/habitat
Student PowerPoint

PROBLEM SOLVING: TRANSPORTATION AND SPACE

REUSE AND RECYCLE

http://explorerschools.nasa.gov
Educator Guide


http://explorerschools.nasa.gov
Related Lessons
Elementary

• Moon Munchies -- Lunar Plant Growth Chamber (Grades K-4)
• Moon Power -- Energy and Power (Grades 1-5)

http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/HEP_Transportation.html
Related Lessons
Middle Grades

- Lunar Colonization -- Energy and Power (Grade 6)
- Packing Up for the Moon -- Lunar Plant Growth Chamber (Grades 5-8)

http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/HEP_Transportation.html
Related Lessons
Middle Grades

- Creating a Space Exploration Infrastructure -- Transportation (Grade 7)
- Space Transportation: Reshooting the Moon - Transportation (Grade 8)

http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/HEP_Transportation.html
Related Lessons

High School

- Engineering Design for Human Exploration -- Energy and Power (Grades 9-12)
- Lunar Plant Growth Chamber (Grades 9-12)
- NASA: Moving Cargo -- Transportation (Grade 9)

http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/HEP_Transportation.html
Website for Lunar Historic Sites Recommendations

http://www.nasa.gov/audience/foreducators/topnav/materials/listbytyp/HEP_Transportation.html
QUESTIONS?
Online Resources

- Live web seminars
- Teacher video collection
- Slide presentation
- Other digital resources
Collaboration
Log Your Participation

Professional Development

Click here to find the live web seminars scheduled for this featured lesson. Web seminars are led remotely by NASA subject matter experts and education specialists.

Click here to access the teacher video collection for this featured lesson.

Log Your Participation

to become eligible for NES Recognition
Completed surveys will be added to your My Activities page

Take the Lesson Survey
Take the Professional Development Survey

Educators Can Earn CEUs for Participating in NES Live e-PD!
NES, in cooperation with Oklahoma State University, announces the opportunity for educators to earn Continuing Education Units!

Read More
QUESTIONS?
Thank you

http://explorerschools.nasa.gov
Thank you to the sponsor of tonight's Web Seminar:

This web seminar contains information about programs, products, and services offered by third parties, as well as links to third-party websites. The presence of a listing or such information does not constitute an endorsement by NSTA of a particular company or organization, or its programs, products, or services.
National Science Teachers Association
Gerry Wheeler, Interim Executive Director
Zipporah Miller, Associate Executive Director, Conferences and Programs
Al Byers, Ph.D., Assistant Executive Director, e-Learning and Government Partnerships

NSTA Web Seminars
Paul Tingler, Director
Jeff Layman, Technical Coordinator
Brynn Slate, Program Coordinator

LIVE INTERACTIVE LEARNING @ YOUR DESKTOP