



NASA/NSTA Symposium: Living and Working in Space: Habitat Friday, March 30, 2007

Essential Question: What kinds of habitats can be designed to support extended human activity in space or on the Moon or Mars?

Introduction

Humans meet basic needs for food, water, air, shelter and the more intangible psychological and social needs within ecosystems of Earth's biosphere. As humans have moved off the planet and explored space and other planets, National Aeronautics and Space Administration (NASA) has been developing ways to support humans for longer and longer periods of time away from Earth.

8:30 AM – 9:00 AM

Welcome, Introductions, Goals for the Symposium

Al Byers, Assistant Executive Director of Government Partnerships and e-Learning, NSTA
Trena Ferrell, NASA Explorer Schools Workshop Coordinator, NASA Headquarters
Flavio Mendez, Symposia and Web Seminars Program Manager, NSTA

- About NSTA Symposia
- Agenda/Goals
- Forms/Logistics/Introductions

Dr. Doug Ming, Space Scientist, NASA Johnson Space Center

Dr. Carolyn Lowe, Associate Professor of Science Education, Northern Michigan University

Don Boonstra, Coordinator Student Observation Network, NASA Goddard Space Flight Center

Sheri Klug, Director of the Mars Education Program, Arizona State University

Brian Grigsby, Assistant Director of the Mars Education Program, Arizona State University

9:00 AM – 9:30 AM

The Sealed Room: Engagement and Overview

Don Boonstra

Learning Outcome:

After participating in the presentation,

- Participants will describe the goals of the workshop.
- Participants will list basic requirements for humans to live in a closed ecosystem.

9:30 AM – 10:00 AM

Ecosystems

Dr. Carolyn Lowe

Learning Outcomes:

After participating in the presentation,

- Participants will describe and explain the concepts of ecosystem, habitat, population and community as they apply to the bottle habitats and other closed systems.
- Participants will relate the overall process, purpose and ecological impacts of photosynthesis to their bottle habitats and other closed systems.
- Participants will relate the overall process, purpose and ecological impacts of respiration to their bottle habitats and other closed systems.
- Participants will describe how various cycles work in their habitats and closed systems including: carbon, water, and nitrogen.

- Participants will explain food and energy pyramids and how they apply to a closed system such as their bottle habitats.

10:00 AM – 10:15 AM

Break

10:15 AM – 11:00 AM

Activity 1: Life in a Bottle

Dr. Carolyn Lowe

Learning Outcomes:

After participating in the activity,

- Participants will develop a bottle habitat design to test a variable that might determine the success of a closed ecosystem.

11:00 AM – 11:45 AM

Activity 2: Getting Dirty on Mars

Brian Grigsby

Learning Outcomes:

After participating in the activity,

- Participants will list and describe importance of soil properties and be able to relate that information to students.
- Participants will determine soil properties such as pH levels, and specific chemical levels using a soil test kit.
- Participants will describe the kinds of soil tests being performed by spacecraft on Mars.

11:45 AM – 12:30 PM

Lunch/Taste-Testing for Mars

12:30 PM – 1:00 PM

Living in a Closed System – as only NASA Can: Part I

Dr. Doug Ming

Learning Outcomes:

After participating in the presentation,

- Participants will describe three life-support technologies developed by NASA to keep humans alive in space for extended periods of time.
- Participants will select a life-support technology and describe how it replaces the function of a system in an Earth ecosystem.

1:00 PM – 1:30 PM

Activity 3: Menu for Mars

Don Boonstra

Learning Outcomes:

After participating in the activity,

- Participants will develop a daily menu using correct calorie requirements and the Food Pyramid and extend this information to a menu for an astronaut on Mars.

1:30 PM – 2:00 PM

Living in a Closed System – as only NASA Can: Part II

Dr. Doug Ming

Learning Outcomes: See Part I

2:00 PM – 2:15 PM

Break

2:15 PM – 2:30 PM

Martian Environment

Sheri Klug

Learning Outcomes:

After participating in the presentation,

- Participants will list similarities and differences between Earth and Mars that could affect living on Mars.

2:30 PM – 3:15 PM

Activity 4: Design Mars Habitat

Sheri Klug and Don Boonstra

Learning Outcomes:

After participating in the activity,

- Participants will propose and defend their design of a Martian research habitat for six explorers integrating the necessary requirements for humans to survive.

3:15 PM – 4:00 PM

Group Presentation: Habitat Designs

Sheri Klug and Don Boonstra

Learning Outcomes:

After participating in the activity,

- Participants will present their design of a Martian research habitat and will explain how their design provides a crew of six the necessary requirements to survive.

4:00 PM – 4:30 PM

Learning Opportunities

Don Boonstra

Learning Outcomes:

After participating in the presentation,

- Participants will locate resources on the SON module, *Living and Working in Space: Habitat*, and the STS-118 education web page necessary to use habitat concepts and STS-118 mission into their classrooms.

4:35 PM – 5:00 PM

Final Words

- Post-assessment form
- Evaluation form/Survey/Credit info
- NSTA Web Seminars
- Raffle of door prizes

Objectives for Living and Working in Space: Habitat

<http://www.nasa.gov/audience/foreducators/son/home/index.html>

1. Using data from investigations of plant growth variables and simple, closed ecosystems, student discover and demonstrate conditions necessary for successful ecosystems that could support humans in extraterrestrial habitats.
2. Students demonstrate an understanding of proper nutrition and exercise by developing and explaining a diet and exercise regimen to support healthy human activity in a habitat on Moon or Mars.
3. Students demonstrate an understanding of chemical cycles (CO₂, O₂, H₂O) in ecosystems by proposing and defending a design for maintaining clean water and breathable air for six humans in a habitat on Moon or Mars.
4. Students demonstrate an understanding of the recycling of matter in an ecosystem by designing and explaining methods for handling waste in a habitat for six humans on Moon or Mars.

National Science Education Standards Addressed: Content Standards, 5-8

Content Standard C:

Life Science

As a result of their activities in grades 5-8, all students should develop an understanding of

- Populations and Ecosystems
 - For ecosystems, the major source of energy is sunlight. Energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis. That energy then passes from organism to organism in food webs.
 - The number of organisms an ecosystem can support depends on the resources available and abiotic factors, such as quantity of light and water, range of temperatures, and soil composition. Given adequate biotic and abiotic resources and no disease or predators, populations (including humans) increase at rapid rates. Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem. *This is the key Content Standard for the symposium.*

Content Standard F:

Science in Personal and Social Perspectives

As a result of their activities in grades 5-8, all students should develop understanding of

- Personal Health
 - Regular exercise is important to the maintenance and improvement of health. The benefits of physical fitness include maintaining healthy weight, having energy and strength for routine activities, good muscle tone, bone strength, strong heart/lung systems, and improved mental health. Personal exercise, especially developing cardiovascular endurance, is the foundation of physical fitness.
 - Food provides energy and nutrients for growth and development. Nutrition requirements vary with body weight, age, sex, activity, and body functioning.

National Science Education Standards *Pre-Requisite Understandings:* Content Standards, K-4

Content Standard C: Life Science

As a result activities in grades K-4, all students should develop understanding of

- The characteristics of organisms
 - Organisms have basic needs. For example, animals need air water, and food; plants require air, water, nutrients, and light. Organisms can survive only in environments in which their needs can be met.
- Organisms and environments
 - All animals depend on plants. Some animals eat plants for food. Other animals eat animals that eat plants.
 - Humans depend on their natural and constructed environments. Humans change environments in ways that can be either beneficial or detrimental for themselves and other organisms.

Content Standard F: Science in Personal and Social Perspectives

As a result of activities in grades K-4, all students should develop understanding of

- Personal Health
 - Individuals have some responsibility for their own health. Students should engage in personal care--dental hygiene, cleanliness, and exercise--that will maintain and improve health. Understandings include how communicable diseases, such as colds, are transmitted and some of the body's defense mechanisms that prevent or overcome illness.
 - Nutrition is essential to health. Students should understand how the body uses food and how various foods contribute to health. Recommendations for good nutrition include eating a variety of foods, eating less sugar, and eating less fat.
- Types of resources
 - Resources are things that we get from the living and nonliving environment to meet the needs and wants of a population.
 - Some resources are basic materials, such as air, water, and soil; some are produced from basic resources, such as food, fuel, and building materials; and some resources are nonmaterial, such as quiet places, beauty, security, and safety.
 - The supply of many resources is limited. If used, resources can be extended through recycling and decreased use.
- Changes in environments
 - Environments are the space, conditions, and factors that affect an individual's and a population's ability to survive and their quality of life.
 - Changes in environments can be natural or influenced by humans. Some changes are good, some are bad, and some are neither good nor bad. Pollution is a change in the environment that can influence the health, survival, or activities of organisms, including humans.