National Center
for Earth and Space Science Education

Universities Space Research Association

Introduction to the *Journey through the Universe* Program and the *Building a Permanent Human Presence in Space* Module's Grade K-4 Lessons

1. The Program

Journey through the Universe (http://journeythroughtheuniverse.org) is a national science education initiative that engages *entire* communities—students, teachers, families, and the public—using education programs in space exploration and the space sciences to inspire and captivate. The initiative embraces the notion that—*it takes a community to educate a child.*

Journey through the Universe programming is tailored to a community's strategic needs in science, technology, engineering, and mathematics (STEM) education, and is a framework for partnership between school districts, museums and science centers, colleges and universities, civic and business organizations, and the public. The cornerstone philosophy for all programming is—*inspire… then educate.*

2. The Grade K-12 *Building a Permanent Human Presence in Space* Education Module

Building a Permanent Human Presence in Space is one of several Education Modules developed for the *Journey through the Universe* program. The Module contains activities at three grade levels (K-4, 5-8, 9-12). Each grade level package is called an **Education Unit.** The Module also includes one Family and Home activity, and one activity on the Process of Science. Both are suitable for use at all grade levels.

The United States and its partners around the world are building an International Space Station (ISS), arguably the most sophisticated engineering project ever undertaken. ISS will provide a permanent human presence in low Earth orbit. The scientific motivation for developing ISS derives from the extreme nature of the space environment relative to what we experience here on Earth. ISS provides researchers long-term access to space, with its extreme temperature variation; near vacuum conditions; pervasive high-energy radiation; and free-fall conditions that produce the experience of 'weightlessness'. If humans are to extend their presence beyond Earth, these challenges to life in space must be overcome, and ISS provides a laboratory for such research.

Substantial national investment in ISS is grounded in a broad set of needs to explore beyond the confines of our own home. Motivations for *why* we explore are as old as the human race, and should be studied if students are truly going to understand what drives exploration on *every* frontier of human activity.

Motivation, however, is not enough for ISS to be realized. *How* we build a permanent human presence in space requires significant engineering 'know-how' to both lift payloads into orbit and build space habitats.

Therefore the storyline approach adopted for this Module is to address three questions at each grade level:

- What is the space environment like?
- Why do people want to go into space?
- How will we build a place to live in space?

Each grade-level Education Unit has a lesson addressing each of these questions.

3. The *Building a Permanent Human Presence in Space* Grade K-4 Lessons

This document provides a description of each lesson and the embedded inquiry-based activities for the *Building a Permanent Human Presence in Space* **elementary school (grade K-4)** Education Unit. Also provided are connections to grades K-4 National Science Education Standards.

Bulding a Permanent Human Presence in Space: The K–4 Education Unit Progression	
Lesson Title	Lesson Description
Lesson 1: There's More to Light than Meets the Eye	*Storyline question addressed: What is the space environment like?* Students will explore the concept that not all light is visible to the human eye. Although UV light is not visible, it can still be harmful, causing sunburns or skin cancer. Students will use special beads to detect UV light around the school. They will then conduct an experiment to determine what types of materials are best for blocking UV light on Earth, as well as in space.
Lesson 2: Exploration Yesterday and Today	*Storyline question addressed: Why do people want to go into space?* Throughout human history, people have demonstrated a desire to explore. From Ferdinand Magellan through Lewis and Clark to modern-day explorers such as Robert Ballard (who discovered the remains of the Titanic), people are continually pushing the boundaries of their knowledge and abilities. In this lesson, students will investigate the nature of explorations past and present, and identify traits of two very different explorers.
Lesson 3: Solar Arrays for the Space Station	*Storyline question addressed: How will we build a place to live in space?* Engineers must come up with unique designs when developing devices that will be used in space. These designs must meet the demands of the space environment and the limitations of rockets available to launch payloads into orbit. One such challenge is the design of the solar arrays for the International Space Station. In this lesson, students will compare the operating life of solar cells to batteries. They then will use models of the solar arrays and the cargo bay of the Space Shuttle to explore safe, effective ways to package solar arrays for transport into space.

Connection to Standards

This Education Unit has been mapped to the National Science Education Standards (National Research Council, National Academy Press, Washington, DC, 1996). A complete explanation of the Standards can be found at: http://www.nap.edu/html/nses/html/. Core standards for each lesson are indicated by a "√"; related standards are indicated by an "x."

Education Standards In Building a Permanent Human Presence in Space K-4 Education Unit						
	National Science Education Standards					
	Standard A: Science as Inquiry		Standard B: Physical Science	Standard D: Earth and Space Science	Standard E: Science and Technology	
	A1: Abilities necessary to do scientific inquiry	A2: Understanding about scientific inquiry	B3: Light, heat, electricity, and magnetism	D2: Objects in the sky	E1: Abilities of technological design	E2: Understanding about science and technology
Lesson 1: There's More to Light Than Meets the Eye	x	x	√	√		
Lesson 2:Exploration Yesterday and Today	x	x				√
Lesson 3: Solar Arrays for the Space Station	x	x			√	√