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 5-8 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 5-8 Lessons

This document provides a description of each lesson and the embedded inquiry-based activities for the *Building a Permanent Human Presence in Space* **middle school (grade 5-8)** Education Unit. Also provided are connections to grades 5-8 National Science Education Standards.

Building a Permanent Human Presence in Space: The 5–8 Education Unit Progression	
Lesson Title	Lesson Description
Lesson 1: Weightlessnes	*Storyline question addressed: What is the space environment like?* There is no lack of gravity in space. In fact, it is gravity that keeps the Space Shuttle in orbit around the Earth. In essence, the Space Shuttle is falling around the Earth. Why then do astronauts have the feeling and appearance of weightlessness? In this lesson, students will create models of an astronaut and the Space Shuttle to investigate why a falling astronaut feels like he or she is weightless.
Lesson 2: Are You an Explorer?	*Storyline question addressed: Why do people want to go into space?* When you hear the word 'explorer,' what comes to mind? You will likely conjure up visions of noble, courageous men or women, physically battling with nature to achieve some challenging goal against grave personal risk. That isn't the only way to explore, however. People explore the world every day, in many ways, without necessarily traveling to far off lands to do so. In this lesson, students examine the characteristics of explorers. They then create an exploration log to determine whether they too possess these qualities and are also explorers.
Lesson 3: Payload Rocket	*Storyline question addressed: How will we build a place to live in space?* The mass of a rocket can make the difference between a successful flight and a rocket that just sits on the launch pad. In this lesson, students use Newton's Laws of Motion to investigate how a rocket's payload affects the rockets ability to launch by constructing a balloon rocket and using it to carry a paper clip payload.

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 5-8 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		Standard G: History and nature of science
	A1: Abilities necessary to do scientific inquiry	A2: Understandings about scientific inquiry	B2: Motions and forces	B3: Transfer of energy	D3: Earth in the Solar System	E1: Abilities of technological design	E2: Understandings about science and technology	G1: Science as a human endeavor
Lesson 1: Weightlessnes	x	x	√		√			
Lesson 2: Are You an Explorer?	x	x					√	√
Lesson 3: Payload Rocket	x	x	√	√		x	x	