

Living and Working Safely on the Moon: An Education Module. R. A. Millham ¹, E. M. Lewis ², SUNY New Paltz, New Paltz, NY, millhamr@newpaltz.edu ¹, NASA Goddard Space Flighth Center, Greenbelt, MD, Elaine.M.Lewis@nasa.gov ²

Introduction: NASA plans to have humans living and working on the Moon for extended periods of time by the year 2020. This is an exciting time for lunar scientists, engineers, and astronauts who want to continue the exploration of the Moon. However, returning humans to the Moon safely is full of challenges that did not exist, or were unknown, during the Apollo Program. Scientists know a lot more about the activity of the Sun and space weather, and our technology, although advanced, needs to be ready for the challenges of long-duration habitation on the Moon. How can humans live and work safely on the Moon? In what way are the Earth and Moon similar/different?



What are the requirements for sustaining life? These questions and more are investigated in the 'Living and Working Safely on the Moon' (LAWSON), module at <http://www.newpaltz.edu/lunarlander/> and is designed to provide students with the ability to choose acceptable sites on the Moon for a human habitat.

Choices for a lunar habitat location rely on the natural resources existing on the Moon that can be used to sustain human life, protection for humans from solar radiation and space weather caused by solar activity, and in a position to allow communications with Earth at all times. It is a journey from Earth's own life-supporting system, to humans living in the hostile environment found on the lunar surface.

Standards-based and focused on misconceptions about the Moon, sixteen teacher guides on topics ranging life-sustaining resources and basic Earth science to the science of the Moon are included for grades 5-8 and 9-12. Teachers can choose to do one or all of the lessons depending on curricular needs. Each guide includes essential questions, education standards, Five E's constructivist lessons, engaging inquiry, student handouts, and scientifically valid content. Additional student resources necessary to complete investigations, and additional support material such as videos, maps, and science articles, are referenced or included in each teacher guide.

Each teacher guide, with lessons, is a stand-alone document and does not require that any other part of the module be used prior to, or following, any other activity/lesson.

Grades 5-8 and 9-12 Teacher Guides with Lessons

1. Engagement Activities: These are designed to engage students in wanting to learn about the Moon and human habitation

- a) Requirements for Sustaining Life on Earth
- b) Student Observations of the Moon
- c) Why Go Back to the Moon?
- d) Challenges of Returning Humans to the Moon

2. Earth Environment Activities: Life-sustaining characteristics of the Earth and the environment.

- a) Pre-Requisite Understandings of the Earth System
- b) Solar Energy and the Earth
- c) Life Sustaining Resources of the Earth System

3. Lunar Environment: Background on the properties and characteristics of the lunar environment.

- a) Basic Properties and Characteristics of the Moon
- b) The Moon's Motion in Space
- c) Origin of the Moon
- d) Lunar Mapping
- e) Solar Radiation and the Moon
- f) The Lunar Environment
- g) Resource Mapping of the Moon

4. Earth/Moon Comparisons: Similarities, differences, and how humans can adapt and use lunar resources for humans living and working on the Moon.

- a) Comparing Earth and Moon
- b) Choosing a Location for a Human Habitat on the Moon

5. Habitats on the Moon: Fun activities for designing a sustainable human habitat on the Moon

- a) Selected activities in developing habitats on the Moon are the components of this portion of the module.

Additional Information: If you have any questions or need additional information, please contact Rosemary Millham, Ph.D. at millhamr@newpaltz.edu or 845-257-3118. All materials are free and can be downloaded in PDF format from the university website at <http://www.newpaltz.edu/lunarlander/>