

# A Guide To FIELD TRIP TO THE MOON

## INSIDE:

- More about the live dome show
- Places to explore in the Museum
- Activity ideas for after your visit



[education.amnh.org/ftm](http://education.amnh.org/ftm)

## Get ready to experience **A FIELD TRIP TO THE MOON!**

**“Mission Control ...  
we’re ready for lift off”**

In the immersive setting of the Hayden Planetarium, you will come face-to-face with the challenges and excitement of launching from Earth’s surface and journeying through space to land on the Moon. On the way, you’ll discover some of the differences between Earth and the Moon, and what makes our planet unique and habitable.

**Fasten your virtual seatbelts and enjoy the journey!**

**SHOW LENGTH:** 30 minutes

**NOTE:** If you feel dizzy during the show, simply close your eyes and let the feeling pass.

**PRESHOW:** Test your knowledge about the Moon and find out more about the history of NASA’s Apollo program and lunar missions.

## CREDITS



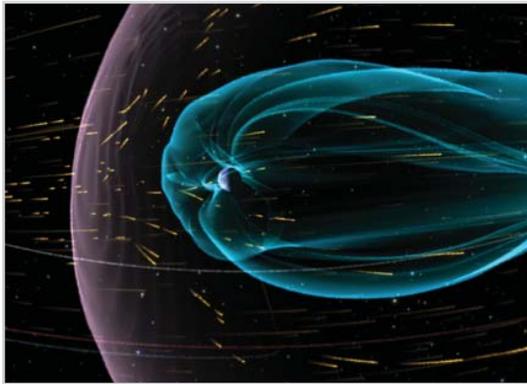
Significant educational and programming support has been provided by the National Aeronautics and Space Administration (NASA)

### IMAGE CREDITS:

Earth, Moon, and illustrations of lunar base and spacecraft landing, © NASA; solar wind, © NASA, ESA, SOHO; bronze Moon model, Moon rock, ecosphere, and illustration of magnetic field, © AMNH.

## The Earth System Has Natural Defenses

Harmful radiation, fast-moving meteors ... outer space can be a dangerous place. Luckily, our planet is protected by its natural defenses.



Earth is protected by an invisible magnetic field, visualized here in blue.

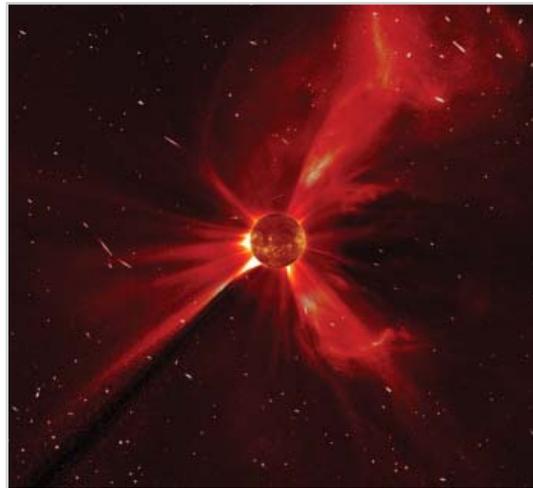
Produced by the rotation of Earth's liquid outer core, Earth's **magnetic field** shields us from energetic particles in the solar wind. These particles stream off the Sun's surface at more than a million miles an hour, and can damage the DNA in living organisms.

The **atmosphere** also protects us. Most of the tons of rock and dust from space that collide with Earth's atmosphere every day burn up through friction before they hit the ground.

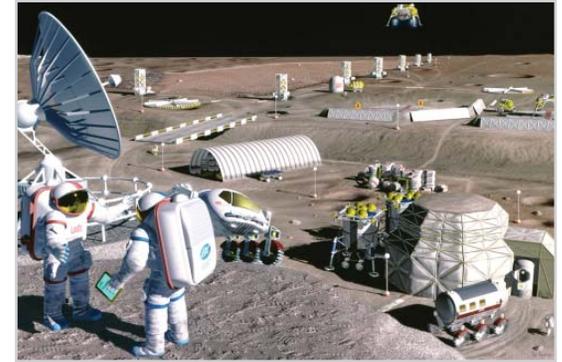
## The Lunar Environment Is Unprotected

Without a magnetic field or an atmosphere, the Moon is exposed to the Sun's **radiation** and potential **impacts**.

Moon explorers also face many other challenges. There is electrically charged soil that makes **moondust** cling to everything. And without an atmosphere to moderate the Moon's **temperatures**, it gets as cold as  $-250^{\circ}\text{F}$  and as hot as  $250^{\circ}\text{F}$ !



Solar wind blasts from the Sun's surface.



Artist's rendition of future commercial lunar base.

## The Moon Is Vital to Human Space Exploration

Did you know that humans plan to once again land on and explore the Moon?

In decades ahead, NASA plans to build a new **outpost** on the Moon. This site, along with the International Space Station, will be a place for astronauts to prepare for **missions** to Mars and beyond. They will be testing new approaches, systems, and operations for sustainable human and robotic missions.



## AFTER THE DOME SHOW

### The journey has just begun!

Now that you've landed on the Moon, it's time to take a closer look.

### EXPLORE THE MOON THROUGHOUT THE MUSEUM

Check out the exhibitions featured on page 4. You'll find a touchable Moon model, amazing photos taken by astronauts, and more.

**Educators:** Prior to your visit, photocopy and distribute the student worksheets on pages 5 and 6, to support your students' investigations.

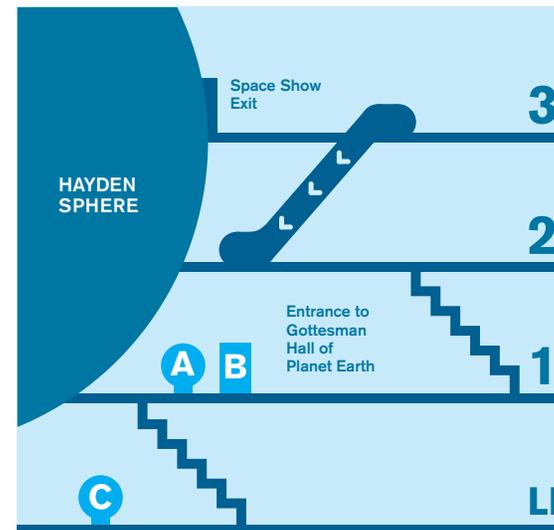
### CONTINUE YOUR EXPLORATION AT HOME OR IN THE CLASSROOM

Visit the Field Trip to the Moon website at [education.amnh.org/ftm](http://education.amnh.org/ftm) for fun hands-on activities. You can *Design a Lunar Base* and *Compete in the Lunar Olympics!*



Check out the exhibits featured on the following page to continue your investigation of the Moon and human space exploration. Use this map to help you locate the investigations.

### Rose Center for Earth and Space



### See What the Astronauts Saw

Check out **photographs of Apollo missions** to the Moon throughout the 1st floor of the Rose Center.

- How does the Moon look different than Earth? How does it look the same?
- What do you think it would be like to walk on the Moon?

# THE JOURNEY CONTINUES...

## INVESTIGATE THE MOON

### EXPLORE a Moon Model



#### **A** WHERE?

Rose Center, 1st floor & Gottesman Hall of Planet Earth

Touch the surface of this **bronze Moon model**.

- Can you feel the craters? How has the Moon been shaped by collisions?

- Compare the near and far sides of the Moon. Why do you think they are similar or different?
- BONUS: Can you find the Aitken Basin and mare that you saw during the show?

Then enter the Gottesman Hall of Planet Earth and explore the **bronze Earth model**. It represents the solid surface of Earth without the water.

- Can you find your home?
- How do the surfaces of the Moon and Earth compare?

#### **DID YOU KNOW?**

Earth's surface is constantly reshaped by processes such as volcanic eruptions, earthquakes, mountain building, and erosion. So scientists study lunar craters for clues to past impacts on both the Moon and Earth!

#### **MOON Connection**

Scientists study the differences between Earth and the Moon to determine what it will take for future astronauts to survive there.

- What are some of the differences between the Moon and Earth?
- What are some of the hazards that astronauts will face on the Moon?

## INVESTIGATE GEOLOGY

### EXAMINE a Moon Rock

#### **B** WHERE?

Rose Center, 1st floor & Gottesman Hall of Planet Earth



Look for the **Moon rock** within the wall near the bronze Moon model. It was retrieved by Apollo 15 astronauts.

- What does it look like?
- What is it made of?

Enter Gottesman Hall of Planet Earth and explore the How Do We Read the Rocks? section.

- Which rock sample looks similar to the Moon rock? What type of rock is it?
- Do you think the Moon rock is igneous, sedimentary, or metamorphic? Why?

Next visit the Effusive Volcanism section and find the basalts from Hawaii.

- Read the panel text. How do basalts form?
- Since the Moon rock is a basalt, what does it tell you about the Moon?

#### **DID YOU KNOW?**

Early in the Moon's history, massive lava flows spread across the lunar surface, creating the vast maria. The Moon has not been geologically active for more than 3 billion years. There's no wind blowing, water flowing, or tectonic plates moving, to shape its surface.

#### **MOON Connection**

Scientists study the Moon's geology to understand its formation, structure, and composition.

- What do we learn about the formation of the Moon by studying its rocks?
- Why is it important for scientists to understand lunar geology if we are planning to inhabit and explore the Moon?

## INVESTIGATE ECOSYSTEMS

### OBSERVE an Ecosphere

#### **C**

**WHERE?** Rose Center, Lower Level



This 39-inch **glass sphere** is a simple example of a self-sustaining ecosystem. It has been sealed since 1999.

- What do you see inside?
- What do you think is living and nonliving?
- What keeps the organisms alive even if the ecosphere remains unopened?

#### **DID YOU KNOW?**

This community of organisms depends on each other and their surroundings. Sunlight, together with CO<sub>2</sub> in the water, enables **green algae** to produce oxygen by photosynthesis. **Brine shrimps** breathe the oxygen and graze on algae and bacteria. **Bacteria** break down the shrimps' waste into nutrients, which in turn feed the algae. Shrimps and bacteria also give off CO<sub>2</sub> and the cycle continues.

#### **MOON Connection**

In order to live on the Moon, scientists need to design a self-sustaining ecosystem.

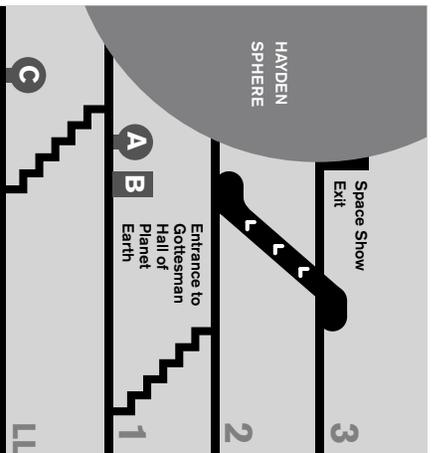
- What do humans need to live?
- What would an ecosystem on the Moon look like?



## THE JOURNEY CONTINUES...

Now that you've landed on the Moon, it's time to take a closer look. Visit these exhibits to investigate the Moon and human space exploration.

### Rose Center for Earth and Space



### See What the Astronauts Saw

Check out **photographs of Apollo missions** to the Moon throughout the 1st floor of the Rose Center.

- How does the Moon look different than Earth? How does it look the same? \_\_\_\_\_
- What do you think it would be like to walk on the Moon? \_\_\_\_\_

## INVESTIGATE THE MOON

### EXPLORE a Moon model

**A** Rose Center, 1st floor & Gottesman Hall of Planet Earth

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- Can you feel the craters? How has the Moon been shaped by collisions? \_\_\_\_\_
- Compare the near and far sides of the Moon. Why do you think they are similar or different? \_\_\_\_\_
- **BONUS:** Can you find the Aitken Basin and mare that you saw during the show? \_\_\_\_\_

**Then enter the Gottesman Hall of Planet Earth and explore the bronze Earth model (try spinning it). It represents the solid surface of Earth without the water.**

- Can you find home? What do you see on this model that you normally don't see on a map? \_\_\_\_\_
- How do the surfaces of the Moon and Earth compare? \_\_\_\_\_

### MOON Connection

Scientists study the differences between Earth and the Moon to determine what it will take for future astronauts to survive there.

- What are some of the differences between the Moon and the Earth? \_\_\_\_\_
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**MOON Connection**

In order to live on the Moon, scientists need to design a self-sustaining ecosystem.

- What do humans need to live? \_\_\_\_\_  
\_\_\_\_\_
- What would an ecosystem on the Moon look like? \_\_\_\_\_  
\_\_\_\_\_