ABOUT THE SHOW

EDUCATOR GUIDE

INSIDE NASA

FROM DREAM TO DISCOVERY

Museum of Science®

About This Guide

INSIDE NASA
FROM DREAM TO DISCOVERY

Introduction

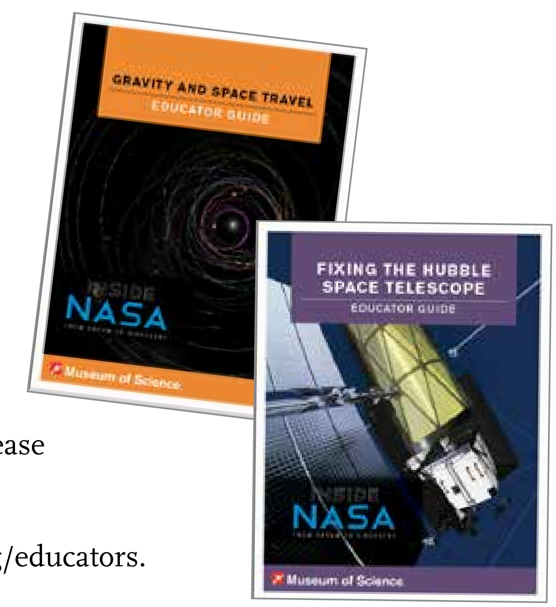
This Educator Guide is designed to support the Planetarium show *Inside NASA: From Dream to Discovery*, produced by the Museum of Science, Boston. Included are:

- A show synopsis
- A list of connections to the:
  – Next Generation Science Standards
  – Massachusetts Science and Technology/Engineering Standards (2013 Draft)
  – Massachusetts Science and Technology/Engineering Curriculum Framework (2001)
- Suggested exhibits at the Museum of Science that have themes consistent with *Inside NASA: From Dream to Discovery*.

Additional Resources

In addition to this guide, a series of educator guides containing detailed information or activities about individual themes within the show can be found on the mos.org/fulldome website. Themes include:

- Design a Mission
- Fixing the Hubble Space Telescope
- Gravity and Space Travel
- Infrared Astronomy
- Waves and Information Transfer



Contact Information

If you have any questions about the materials or the show, please email athompson@mos.org.

- For general field trip planning resources, visit mos.org/educators.
- For school group reservations, call Science Central, open daily 9:00 a.m. – 5:00 p.m.: 617-723-2500, 617-589-0417 (TTY).

Thank you for using these materials!

Show Synopsis

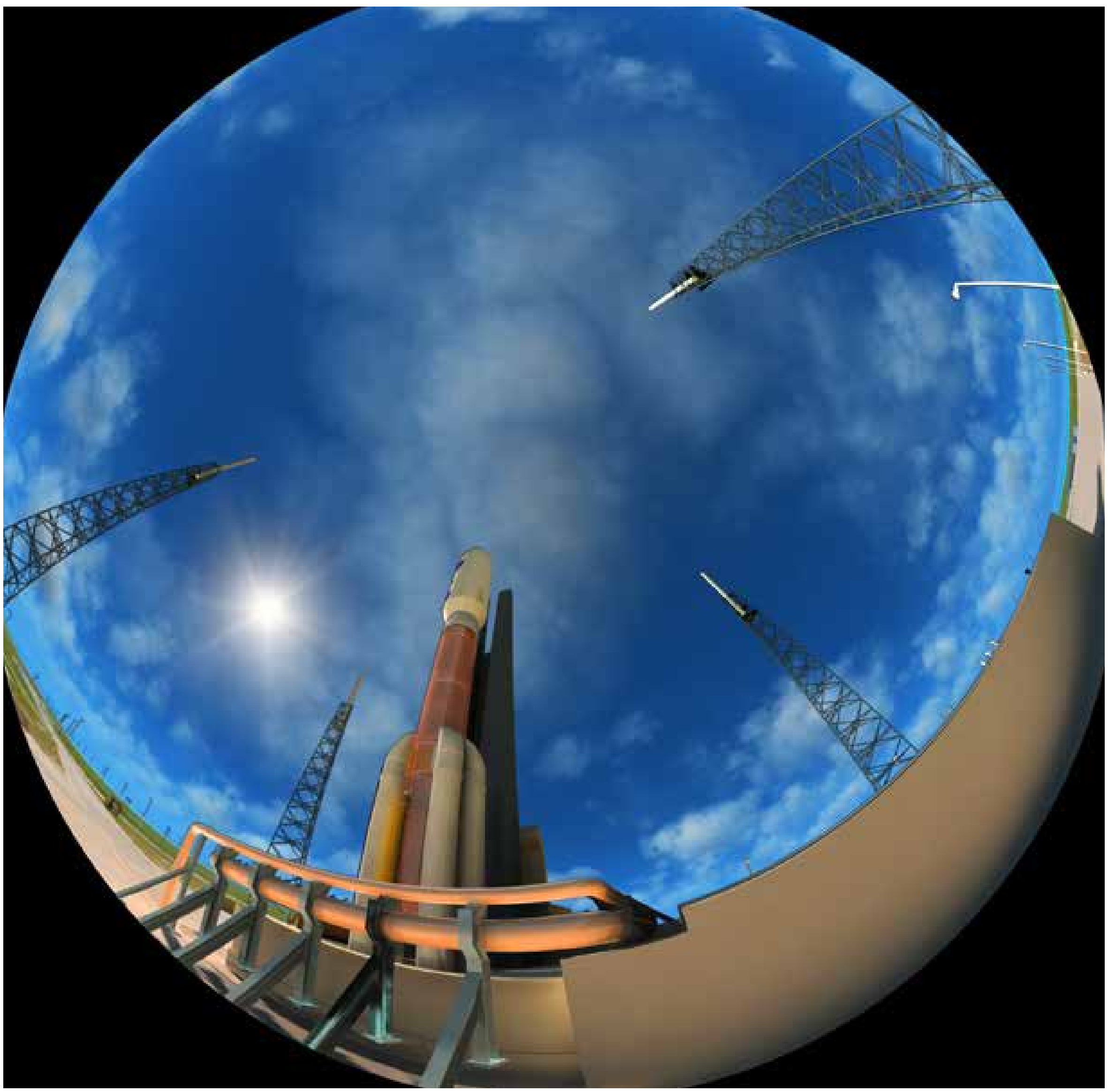
Humans are born explorers and engineers. We challenge ourselves with increasingly difficult questions about the world around us, questions that drive us to create machines, tools, and technologies to help us in our quest.

***Inside NASA: From Dream to Discovery* begins with an exploration of the Hubble Space Telescope and its many components, all of which must work together so that the telescope can do its job.** To improve upon its legacy, engineers are now building the next great orbiting observatory: the James Webb Space Telescope (Webb). However, Webb comes with some significant design challenges: it must be huge, it must stay cold, and it must be placed far out in space.

To overcome these challenges, engineers use tools like the Integration and Testing facility at NASA's Goddard Space Flight Center. We travel through the facility on screen, peeking into the chambers responsible for pushing the spacecraft components to their very limits. All spacecraft must pass through tests like these, and it is up to engineers to learn from their data and any failures in order to create a mission truly ready for launch.

We move from the testing facility to Kennedy Space Center to watch the launch of the New Horizons probe, destined for Pluto. As part of its journey, New Horizons uses Jupiter's enormous gravity for a speed boost, whittling down the entire trip to only nine years. When New Horizons arrives at Pluto, engineers and scientists will be waiting anxiously for confirmation that all their work has paid off.

From design to creation to launch, engineering is an exciting process. Through ingenuity and persistence, humans have the ability to take the impossible and make it reality. As we continue to push the limits, it's up to future generations to take us farther into the frontier of space.



Connections to Education Standards

INSIDE NASA
FROM DREAM TO DISCOVERY

Next Generation Science Standards:

PERFORMANCE EXPECTATIONS	
3-5-ETS1-1	Define a simple design problem reflecting a need or a want that includes specific criteria for success and constraints on materials, time, or cost.
3-5-ETS1-3	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
HT-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

TEACHER TIP

DOWNLOAD FIELD TRIP GUIDES!

Use these handy activity sheets for chaperones and students to make the most of their day at the Museum. Download them before your visit: mos.org/educators.

Massachusetts Science and Technology/Engineering Standards (2013 Draft)

STANDARDS	
3-5-ETS1-1	Define a simple design problem that reflects a need or a want. Include criteria for success and constraints on materials, time, or cost that a potential solution must meet.
3-5-ETS1-3	Plan and carry out tests of one or more elements of a model or prototype in which variables are controlled and failure points are considered to identify which elements need to be improved. Apply the results of tests to redesign a model or prototype.
3-5-ETS1-5 (MA)	Evaluate relevant design features that must be considered in building a model or prototype of a solution to a given design problem.
3-5-ETS2-2 (MA)	Describe that technological products or devices are made up of parts. Use sketches or drawings to show how each part of a product or device relates to other parts in the product or device.
MS-ETS1-2	Evaluate competing solutions to a given design problem using a systematic process to determine how well each meets the criteria and constraints of the problem. Use a model of each solution to evaluate how variations in one or more design features, including size, shape, weight, or cost, may affect the function or effectiveness of the solution.
MS-ETS1-4	Generate and analyze data from iterative testing and modification of a proposed object, tool, or process to optimize the object, tool, or process for its intended purpose.
MS-ETS2-2 (MA)	Given a design task, select appropriate materials based on specific properties needed in the construction of a solution.
HS-ETS1-2	Break a complex real-world problem into smaller, more manageable problems that each can be solved using scientific and engineering principles.
HS-ETS3-2 (MA)	Use a model to explain how information transmitted via digital and analog signals travels through the following media: electrical wire, optical fiber, air, and space. Analyze a communication problem and determine the best mode of delivery for the communication(s).

Massachusetts Science and Technology/Engineering Curriculum Framework (2001)

GRADE LEVEL	SUBJECT	LEARNING STANDARD
3 – 5	Technology/ Engineering	1.1: Identify materials used to accomplish a design task based on a specific property, i.e., weight, strength, hardness, and flexibility.
3 – 5	Technology/ Engineering	2.3: Identify relevant design features (e.g., size, shape, weight) for building a prototype of a solution to a given problem.
6 – 8	Technology/ Engineering	1.1: Given a design task, identify appropriate materials (e.g., wood, paper, plastic, aggregates, ceramics, metals, solvents, adhesives) based on specific properties and characteristics (e.g., weight, strength, hardness, and flexibility).
6 – 8	Technology/ Engineering	2.1: Identify and explain the steps of the engineering design process, i.e., identify the need or problem, research the problem, develop possible solutions, elect the best possible solution(s), construct a prototype, test and evaluate, communicate the solution(s), and redesign.
6 – 8	Technology/ Engineering	2.5: Explain how such design features as size, shape, weight, function, and cost limitations would affect the construction of a given prototype.
9 or 10	Physics	6.1: Describe the electromagnetic spectrum in terms of wavelength and energy, and be able to identify specific regions such as visible light.
9 or 10	Technology/ Engineering	1.1: Identify and explain the steps of the engineering design process, i.e., identify the problem, research the problem, develop possible solutions, select the best possible solution(s), construct a prototype, test and evaluate, communicate the solution(s), and redesign.

Related Museum Programming

Your journey to the stars continues! With astronomy-related offerings located throughout the Museum's Exhibit Halls, you and your students can continue your extraterrestrial explorations for a day filled with the excitement of learning.

Photo © Michael Malyszko

Cosmic Light *outside Planetarium, Red Wing, Level 1*

Almost everything we know about the universe comes from studying light. In this exhibit, students explore the Milky Way Galaxy to discover how different wavelengths on the electromagnetic spectrum can offer a range of information about our universe. Students can also visit scale models of our solar system's planets and even touch a 50,000 year old meteorite.

The Light House *Blue Wing, Level 2*

Explore the science behind light and color. Students can play with light using a variety of mirrors and filters, or learn about color addition using a specially-lit wall. This exhibit provides lots of opportunities for interactivity and inquiry.

Free with Exhibit Halls admission.

Related Museum Programming

INSIDE NASA FROM DREAM TO DISCOVERY

Photo © Nicolaus Czarnecki

To the Moon *Blue Wing, Lower Level*

This exhibit features full-size models of the Apollo and Mercury capsules and a graphic timeline documenting the key era of human space exploration. Students can crawl into the "Apollo Command Module," and watch the first Moon landing from the cockpit seats! Or stand in front of a full-size model of the cockpit of the "Lunar Module," and see real moon rock fragments. *Free with Exhibit Halls admission.*

Take a Closer Look *Blue Wing, Lower Level*

Learn about ways technology can extend our reach beyond what we can perceive on our own. This exhibit includes an infrared camera, helping students understand the idea of light as heat as they see infrared projections of themselves on screen. *Free with Exhibit Halls admission.*

Design Challenges *Blue Wing, Level 1*

Participate in a hands-on activity to learn all about the engineering design cycle. By designing, building, and testing a prototype solution to a given problem, students have a fun and engaging experience with engineering and innovation processes. *Drop-in activity; check mos.org/daily-schedule for schedule. Free with Exhibit Halls admission.*

This material is based upon work supported by NASA under grant number NNX12AL19G. Any opinions, findings, and conclusions or recommendations expressed are those of the Museum of Science, Boston and do not necessarily reflect the views of the National Aeronautics and Space Administration (NASA).