

Catalog of NASA Explorer Schools Online Classroom Resources

NASA Now Videos and Featured Lessons on the Virtual Campus



2013

NASA Now Videos: Seasons 1 – 3

What are NASA Now classroom videos?

Show your students what a scientist, engineer or technician looks like; what they sound like; and what kinds of work they do. These 5-7 minute videos come with vocabulary words, discussion questions and career information to help engage your students by showing real people using what they learned in school to work on NASA missions, research and careers.

Program Title	Grade Level	Post Date	Description
<u>Simulated Lunar Operations SLOPE</u>	4-12	9/4/2010	Watch this program as NASA engineers experiment with different wheel designs for lunar rovers, and learn about the unique properties of the moon's soil and how those properties affect the design of future lunar vehicles.
Flight Testing and the Global Hawk	5-8	9/28/2010	In this NASA Now event, learn about NASA's Global Hawk GloPac missions and how NASA flight-tests new aircraft. Much of NASA's flight-testing is conducted in the high desert of California. The desert's wide open spaces, good weather and the long flat runway at Dryden make it NASA's premier location for conducting atmospheric flight research and operations.
Robonaut 2	9-12	10/6/2010	NASA and partner General Motors are preparing to launch the first humanlike robot into space. Scheduled for launch aboard STS-133 in early November 2010, Robonaut 2 is a dexterous humanoid robot built and designed at NASA's Johnson Space Center in Houston, Texas. The 300-pound Robonaut 2, nicknamed R2, will be the first permanent resident of the International Space Station.
Earth Science Week: Exploring Energy	5-8	10/13/2010	During this installment of NASA Now, you'll see some of the ways NASA studies Earth. You'll meet Eric Brown de Colstoun, a physical scientist at NASA's Goddard Space Flight Center in Greenbelt, Md. He describes his work on a NASA project called the Earth Observing System. The EOS consists of a number of satellites measuring the properties of Earth.
The Search For Life	5-8	10/20/2010	Watch this week's episode of NASA Now and learn about a mission proposal to send a satellite to Jupiter and its moons Europa and Ganymede. The mission will map the Jovian magnetosphere and its interactions with the Galilean satellites. The mission will

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			characterize water oceans beneath the ice shells of Europa and Ganymede, as well as search for signs of life elsewhere in the universe.
Suited for Spacewalking	4-12	10/27/2010	This week on NASA Now, you'll get a sneak peak at the activities related to the upcoming launch of STS-133, the last scheduled shuttle mission of Discovery. You also will meet veteran astronaut Michael Foreman, who will share his experiences as a mission specialist on two spaceflights with five spacewalks under his belt.
Path of an Astronaut	4-12	11/3/2010	Mike Foreman is one of the shuttle astronauts who has lived and worked on the space station. He flew on space shuttle Endeavour in March 2008, and he returned to the station on space shuttle Atlantis in November 2009. During this episode of NASA Now, astronaut Foreman describes his experiences from liftoff to living and working in space.
Inflatable Structures	9-12	11/10/2010	During this installment of NASA Now, NASA senior research engineer Judith Watson describes the project she's currently working on. She's one of a team of engineers at NASA's Langley Research Center who are studying inflatable structures that might one day be used to establish an outpost on the moon or Mars.
A-Train: Clouds	5-8	11/17/2010	During this episode of NASA Now, you'll meet NASA physical scientist Lin Chambers, learn about the role of clouds in the Earth's energy and water cycles, and find out how NASA collects cloud data. CloudSat is a NASA Earth-observing satellite that was launched in 2006, and orbits Earth as part of a group of five satellites known as the "A-Train."
A-Train: Monitoring the Earth System	9-12	12/1/201	The topic for this NASA Now is the Earth system and how NASA uses a constellation of satellites called the A-Train to monitor the Earth system. All five satellites in the A-Train fly over the same location on Earth within 15 minutes of each other collecting data about the current state of the components of the Earth system.
Operation IceBridge	5-8	12/8/2010	During this week's NASA Now program, you'll meet Michael Studinger, Project Scientist for Operation IceBridge. He'll describe the purpose of the IceBridge campaign and how the campaign objectives will be met. He also will explain why studying Earth's ice is important for understanding climate changes and how they related to humans.
Microbes @ NASA: Early Earth Ecosystems	4-8	12/15/2010	What may look like green slime growing on a pond is what scientists call a microbial mat. Microbial mats are living examples of the most ancient biological communities on

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			Earth. As Earth's earliest ecosystems, they are important to understanding the history of life on our planet and are useful models for the search for life elsewhere.
EPOXI Flyby Spacecraft: Close Encounters of the Comet Kind	9-12	12/22/2010	In this installment of NASA Now, you'll meet spacecraft pilot and engineer Steven Wissler, who talks about the challenges of flying a spacecraft remotely from Earth and the excitement of being part of a team that discovers something new about comets.
X-48B Research Aircraft and Green Technology	9-12	1/5/2011	NASA is researching ways to incorporate "green technology" into new airplane designs. One new design uses a blended wing body, which has the potential to enable cleaner, quieter and higher performance in air transportation. Watch this episode to learn more about green technology, test flights and the future
The Mechanics of Solar Panels	9-12	1/12/2011	Solar energy is the primary source of power for today's NASA missions. In this NASA Now, Jeremiah McNatt, electrical engineer at NASA's Glenn Research Center, will demonstrate how solar cells are made and used on the International Space Station.
Expedition 26	9-12	1/19/2011	In this installment of NASA Now, meet associate International Space Station program scientist Tara Ruttle, who talks about the complexity of conducting research from this one-of-a-kind orbiting science lab. The program focus is on biology and biotechnology experiments being conducted on Expedition 26.
Black Holes	9-12	1/26/2011	In this NASA Now episode, Dr. Daniel Patnaude talks about how his team discovered a baby black hole, why this is important and how black holes create tidal forces. Throughout his discussion, Patnaude dispels many common misconceptions about black holes and the nature of the environment surrounding the feature.
Shuttle Engineering: Guidance, Navigation and Flight Control	9-12	2/2/2011	Meet engineer George Hatcher, who talks about the complex system needed to fly the space shuttle. Learn about the instruments that inform the shuttle of its location, how to get where it wants to go, and how to change direction. The program focuses on the technology and physics of this complex spacecraft.
STS-133 -- Engineering challenge: From Earth to Orbit and Return	9-12	2/16/2011	In this episode, George Hatcher explains why the upcoming launch of the space shuttle Discovery is mind-boggling from a physics perspective. He speaks about the extreme accelerations and velocities involved in launching a spacecraft from Earth to orbit and return.

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Propulsion	6-8	2/23/2011	In this week's episode, visit NASA's Spacecraft Propulsion Research Facility, called B-2. Meet Dr. Louis Povinelli and Brian Jones who explain why rockets are built in stages and discuss the importance of testing a rocket before it is sent into space.
Solar Storm	4-8	3/2/2011	Dr. Holly Gilbert, NASA Associate Director for Science, Heliophysics Science Division, presents information about solar storms. You'll learn what a solar storm is and the affect a solar storm can have on astronauts living and working on the International Space Station.
MESSENGER in Orbit	9-12	3/9/2011	Dr. Larry Evans, Senior Scientist for MESSENGER discusses the difficulty of getting to Mercury, the challenges of visiting a planet so close to the sun and what we hope to discover when the spacecraft gets there.
Reasons for the Seasons	5-8	3/16/2011	Dr. Kelly Fast explains the reason for the seasons on Earth, describes what happens during an equinox, and explains whether or not other planets in our solar system have seasons.
Lunar Mathematics and Mapping	9-12	3/23/2011	Dr. James Garvin, Chief Scientist at NASA's Goddard Space Flight Center, discusses the Lunar Reconnaissance Orbiter mission, moon mapping and how LRO is helping us explore the moon like never before!
Air Traffic Management	7-12	3/30/2011	Aerospace engineer Aisha Bowe explains what NASA is doing to increase the number of planes that can fly safely and efficiently across the United States.
Extremophiles	4-8	4/6/2011	NASA research scientists Dr. Margarita Marinova and Dr. Alfonso Davila discuss how scientists study microbes that live in Earth's extreme environments to better understand places where life might exist in our solar system, such as Mars!
STS-134 All Systems Go!	4-8	4/13/2011	George Hatcher explains what it's like to sit at the console in the launch control center during countdown. Learn about the tremendous amount of teamwork necessary for making decisions to ensure a safe launch.
EARTH DAY -- Smog Bloggers	6-8	4/20/2011	How do we know what is in the air we breathe? How can people with asthma predict an attack? How does air quality affect our environment? Dr. Raymond Hoff defines smog and describes how it affects the quality of the air we breathe. Learn how to find the amount of air pollution on any given day where you live.

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STS-134 -- Search for Antimatter	9-12	4/27/2011	The Alpha Magnetic Spectrometer searches for antimatter. Trent Martin, project manager for the AMS experiment at NASA's Johnson Space Center in Houston, explains how NASA will try to answer one of the fundamental questions in modern physics: "What happened to the primordial antimatter?"
Rocket Engineering	9-12	5/4/2011	Mike Schoenfeld, aerospace engineer at NASA's Marshall Space Flight Center discusses his research of fission systems for space power & propulsion.
Nanotechnology and Space	7-9	5/11/2011	In this NASA Now program, Dr. Mike Oye describes the scale of nanotechnology, how properties of matter change and how nanowires could be used in future space exploration.
Human Research on the ISS	4-8	5/18/2011	Liz Warren, NASA Johnson Space Center operations lead for the International Space Station Medical Project, discusses why exercise and nutrition are important to maintaining good health on Earth and even more important to astronauts on the International Space Station.
Expedition 27	4-8	5/25/2011	In this episode of NASA Now, Camille Alleyne, assistant program scientist for the International Space Station, discusses the unique research operating in microgravity aboard the International Space Station. Through this research, we will understand the effects of microgravity on the human body better, further develop technology, and expand our knowledge about our Earth and about the universe.
SLOPE -- Mars Excavation	5-9	6/1/2011	Is it possible to mine Mars or our moon to make oxygen or a propellant for our rockets? Watch NASA Now for the answer. In this episode, hear from Kurt Sacksteder, Chief of the Space Environments and Experiments Branch at Glenn Research Center. Kurt talks about the importance of water on other planets and the tools we are developing to mine water from Martian soil!
Total Lunar Eclipse	6-8	6/8/2011	Meet astronomer Steven Edberg from the Jet Propulsion Laboratory in Pasadena, CA as he sheds some light on the science behind lunar eclipses.
Aquarius Launch		6/15/2011	Dr. David Le Vine, Deputy Principal Investigator for the Aquarius mission discusses why we need to know more about sea surface salinity.
International Space	6-8	6/29/2011	Katie Presson of the International Space Station Payload Operations Integration team

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Station Payload Operations			explains how NASA prepares science experiments for the International Space Station. She discusses safety requirements and describes some unique experiments for education and how teachers and students can be involved.
Solar Radiation and Earth	9-12	8/17/2011	Gary Fleming, chief engineer for NASA's Clouds and Earth Radiant Energy System, describes what happens to solar radiation when it encounters Earth. CERES instruments help scientists understand the complicated balance between the energy from the sun, which Earth absorbs either at the surface or in the atmosphere, and the energy that is radiated from Earth to space.
Phase Change and Forces of Flight: Aircraft Icing Research	9-12	8/24/2011	Tour the Icing Research Tunnel with Judith VanZante, aeromechanical engineer and icing specialist. VanZante explains the hazards of ice on aircraft, how it is formed, and why the research on ice plays a major role in aeronautics. Students will learn how ice forms and its effects on the forces and motion of aircraft.
Forces and Motion: Aerobraking -- Entry, Descent, and Landing	6-8	8/31/2011	Jill Prince explains aerobraking, a technique used by NASA to reduce the amount of fuel required to slow down a spacecraft moving at high speed as it approaches a planet.
Got Math?	4-6	9/7/2011	In this NASA Now program, Jim Garvin, Ph.D., chief scientist at NASA's Goddard Space Flight Center in Greenbelt, Md., explains how mathematics is a vital tool not only in everything happening at NASA but also in solving problems in everyday life. Garvin discusses how mathematics is an integral part of driving rovers on Mars or the moon and how algebra, geometry, trigonometry and calculus are the building blocks for doing some of the coolest jobs in space exploration right here at NASA.
Primitive Asteroids: OSIRIS-Rex	9-12	9/14/2011	Dr. Joseph A. Nuth III, project scientist for the new Origins-Spectral Interpretation-Resource Identification-Security-Regolith Explorer mission, provides an in-depth look at why the OSIRIS-REx mission to a primitive asteroid is so important to understanding our past and how it could impact our future.
Newton's Laws of Motion: Ballistics	7-10	9/21/2011	Newton's Laws of Motion come to life every day in the Ballistics Impact Lab at NASA's Glenn Research Center in Cleveland, Ohio! Aerospace engineer Matt Melis gives a tour of the three gas guns used to study the dynamics of high-speed projectiles and their impact on targets.

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Plate Tectonics: Earthquakes	4-8	9/28/2011	Dr. Greg Lyzenga describes the geology behind earthquakes and explains how scientists are trying to understand the nature of earthquakes.
Engineering Design: Curiosity Mission to Mars	4-8	10/5/2011	Understanding about science and technology: nature of science; science and technology in local, national, and global challenges; engineering design; design process
Earth's Atmosphere: Earth Science Week	7-9	10/12/2011	Dr. Kenneth Pickering talks about the composition of Earth's atmosphere, how it protects life on Earth, and how it is interconnected with the Earth system. Pickering discusses findings from the Deriving Information on Surface Conditions from COlumn and VERtically Resolved Observations Relevant to Air Quality mission. He also explains how we are learning more about Earth's air quality.
The Speed of Sound	8-12	10/19/2011	Learn about sonic booms and the speed of sound from aerospace engineer George Hatcher as he shares the excitement of physics in his description of the space shuttle re-entering Earth's atmosphere.
States of Matter: Finding and Using Water on the Moon	7-10	10/26/2011	Dr. Ed Ethridge explains how NASA can use water found on the moon's surface or other bodies in the solar system to reduce the cost of exploration.
Orbital Mechanics: Earth Observing Satellites	9-12	11/2/2011	Dr. James Gleason, project scientist for NPP, explains what it takes for a satellite to stay in orbit, why there are different types of orbits, and why satellites orbit Earth at different altitudes depending on their purpose.
Biology: Astronaut Health on the International Space Station	8-12	11/9/2011	Join Stephanie Carrizales Flint, a biomedical engineer at NASA Johnson Space Center who is in charge of integrating flight hardware and devices necessary for monitoring the International Space Station, or ISS environment.
Geology: Structure of the Moon	7-12	11/16/2011	Renee Weber of NASA's Marshall Space Flight Center analyzes seismic data from the moon to determine the structure of the interior of the moon.
Exercise Physiology: Countermeasures	4-8	11/30/2011	Learn about the importance of exercising while in space and get a glimpse into one of NASA's laboratories developing and improving the exercise equipment for astronauts on board the ISS.

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Climate Change: Sea Level Rise	6-10	12/7/2011	Learn about the connection between oceans and global climate change. Find out why NASA measures greenhouse gases and how we detect ocean levels from space.
Exploring Asteroids: An Analog Mission	4-8	12/14/2011	Learn how NASA aquanauts living and working in an undersea habitat are helping NASA prepare for future asteroid exploration.
Origins and Evolution of the Universe: Cosmic Dust	8-12	12/21/2011	Varoujan Gorjian explains why the study of cosmic dust is invaluable as humans continue to explore the evolution of our universe.
The Sun: The Impact of Solar Activity on Earth	10-12	1/4/2012	Learn the latest information about the sun's layers, coronal mass ejections, solar flares and solar cycles.
Life Science: Portable Life Support System	4-8	1/11/2012	Learn about the Portable Life Support System, a backpack the astronauts wear during spacewalks.
Forces and Motion: Landing and Impact Research Facility	9-12	1/18/2012	Dr. Richard Boitnott discusses the roles of physics, testing, data collection and analysis when testing the landing system for NASA's Orion Multipurpose Crew Vehicle. These data are used to design a water landing system that best protects the crew and vehicle.
Life Science: Human Life Support on the ISS	7-12	1/25/2012	Find out about the role of chemistry in making sure the astronauts on the ISS have oxygen to breathe, water to drink, and a comfortable temperature in which to live and work.
Electromagnetic Spectrum: NuSTAR	7-9	2/1/2012	Learn how NASA's Nuclear Spectroscopic Telescope Array uses high-energy X-rays to search for and take pictures of the densest, hottest and most energetic regions in the universe.
Earth and Space Science: Asteroids	4-9	2/8/2012	Learn where near-Earth objects are, how big they are and if they pose a threat to our planet.
Earth and Space Science: 100 Billion Planets	6-10	2/15/2012	Learn just how common planets are in our Milky Way galaxy.

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Engineering Design: Wind Tunnel Testing	7-12	2/22/2012	Learn how wind tunnels work and how aircraft designers use them to understand aerodynamic forces.
Forces and Motion: Project Morpheus	7-12	2/29/2012	Learn about Morpheus, a full spacecraft and rocket-powered lander which demonstrates green technology, an autonomous landing and hazard detection technology.
Biology: Extreme Green Biofuels	9-12	3/7/2012	Learn about a NASA indoor laboratory and outdoor greenhouse facility used to study the basic biology of plants as renewable energy sources.
Engineering: Space Suits	4-6	3/14/2012	Meet Malloy Jennings, a Technology Development Engineer, who develops components for the next generation space suit. Jennings explains how the design for the spacesuit is dependent upon the mission astronauts need to complete in space, how astronauts train to work in the suits, and describes each layer of the current EMU.
Materials Science: Thermal Protection Systems	4-8	3/21/2012	Learn about the importance of picking the right materials to build safe spacecraft for space exploration.
Materials Science: International Space Station Testing	7-10	3/28/2012	This experiment provides NASA with a means to study the effects of long-term exposure to space on various materials, computer components and electronic devices.
Lasers and Light: STORMM	9-12	4/4/2012	NASA wants to develop technology that operates autonomously, how STORMM accomplishes this, and how lasers make the project possible.
Scientific Method: Using Robots for Inquiry	6-8	4/11/2012	Learn about NASA's newest rover, Curiosity, and how scientists and robots work together using the scientific method of research.
Engineering Design Process: Hubble Space Telescope	6-8	4/18/2012	Learn how the engineering design process was used to design and plan the spacewalks that were key to the Hubble Space Telescope servicing missions.
MMSEV: The Future of Robotic Exploration	9-12	4/25/2012	Learn about the Multi-Mission Space Exploration Vehicle, or MMSEV.

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Balloon Research	9-12	5/2/2012	Learn about the two types of high-altitude balloons NASA uses to test scientific instruments and spacecraft, and about the Ideal Gas Law and the interaction between temperature and pressure.
Technology: Orbital Debris -- Man-made Objects in Space	9-12	5/9/2012	NASA monitors nearly 22,000 objects in space every single day to keep astronauts and spacecraft safe from orbital debris.
Science as Inquiry: Microgravity Drop Tower	5-8	5/16/2012	Learn about the different ways gravity on Earth and microgravity in space affect matter and how NASA uses a drop tower for testing.
Cryogenics Test Laboratory	9-12	5/23/2012	Find out why NASA researchers study fluids and materials at super cold temperatures for applications on Earth and in space.
Model Aircraft	6-9	5/30/2012	Learn why NASA engineers build model aircraft as well as the materials and steps involved in the building process.
Technology and Design: Multi-Purpose Crew Vehicle	7-12	6/6/2012	Learn about how designing, building and testing are important steps of the engineering process for the Multi-Purpose Crew Vehicle.
Earth and the Solar System: Juno	6-10	6/13/2012	Learn about the Juno spacecraft and what scientists hope to learn when it reaches Jupiter.
Robotics: Curiosity- Liftoff to Landing	4-12	9/5/2012	Nagin Cox, a systems engineer working on the Mars Science Laboratory mission, talks about the challenges scientists, engineers and technicians faced building NASA's most advanced Mars rover, Curiosity, and landing it successfully on Mars.
Forces and Motion: Curiosity -- Entry, Descent & Landing	4-12	9/12/2012	Dr. Anita Sengupta describes the nail-biting seven minutes of terror as Curiosity barreled towards the Martian surface. Learn about specific engineering challenges and how they were tackled to land this giant rover on the surface of Mars.
Geology: Curiosity -- Main Science Goals	4-12	9/19/2012	Dr. Ashwin Vasavada, Deputy Project Scientist for the Mars Science Laboratory, discusses the main science goals for Curiosity, including the investigation of the presence of water and evidence of life on the Red Planet.

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Curiosity -- Looking Forward	4-12	9/26/2012	Dr. Ashwin Vasavada, Nagin Cox and Dr. Anita Sengupta from the Jet Propulsion Laboratory in Pasadena, California explore fundamental questions like: 'Are we alone in the universe?' and 'What is in the universe that can tell us more about our origin?' Some of these questions and more can be answered by the use of robots like Curiosity, but the goal is to eventually send humans to Mars and beyond.
How to Become and Be an Astronaut	4-12	10/17/2012	Learn about the necessary steps to become an astronaut, the job responsibilities of a pilot on the space shuttle and the incredible experience of being in space.
Engineering Design: Living and Working in Deep Space	5-8	11/14/2012	Extended missions to deep space are the next frontier for NASA's space exploration program. Join astronaut Alvin Drew as he discusses the challenges involved with making manned missions to the Moon and beyond possible.
Technology and Design: The Future of Space Exploration	9-12	12/12/2012	John Connolly is a mission designer for the human exploration architecture team that's looking at where we're going to send people into space beyond the International Space Station. He will talk to about the challenges of creating the right spacecraft with the features to match the future missions.
The Future of Space Travel	5-8	1/2/2013	NASA astronaut Greg Johnson discusses the future of space exploration and the logical progression of sending humans to Mars. He talks about sending astronauts back to the moon and the possibility of building a lunar habitat to understand more about working and living in space.
Careers: From Teacher to Astronaut	4-12	1/16/2013	Educator and astronaut Dottie Metcalf-Lindenburger describes her dream job and the exciting adventures of space travel.
Engineering: Friction Stir Welding	9-12	2/6/2013	Shane Brooke, welding engineer at Marshall Space Flight Center in Huntsville, Ala., discusses friction stir welding and its use in the engineering of spacecraft.
The Body in Space	6-12	2/20/2013	Join Dr. Liz Warren as she discussed some very serious negative long-term effects and some interesting short-term changes the human body experiences in space.

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Inspiration and Education: Building a Career at NASA	5-8	3/6/2013	Be sure not to miss this episode of NASA Now, when three experts who work in very different fields at NASA discuss their jobs, responsibilities and what they enjoy most about their work. They also talk about what inspired them to pursue their careers and offer career advice to students.
Jet Engine Testing	9-12	3/20/2013	Queito Thomas, a test operations engineer at NASA's Glenn Research Center in Cleveland, Ohio, discusses how and why his team tests jet engines in the Propulsion Systems Laboratory.

NASA Explorer Schools Featured Lessons

What are NES Featured Lessons?

NES featured lessons link the subjects you teach to NASA's innovative research and missions. Lessons are easy to implement and are educator-reviewed and tested. Each lesson includes a lesson plan, essential question, instructional objectives, multimedia resources, extension activities, national standards and 21st-Century skills addressed. Along with each lesson, NES provides professional development opportunities, including live Web seminars and a teacher video collection that provide guidance for classroom implementation!

Title	Grade Level	Subjects/Topics	Description
Algebraic Equations: Calculator Controlled Robots	6-9	<ul style="list-style-type: none"> • Mathematics: Algebra, Geometry, Measurement • Science • Technology 	Students create programs in calculator robots. Missions are built sequentially on the knowledge of previous missions.

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Algebraic Equations: Transit Tracks -- Finding Habitable Planets	9-12	<ul style="list-style-type: none"> • Mathematics: Algebra 2 • Physical Science: Kepler's Laws of Motion 	In this activity, students will investigate light curve data gathered by Kepler from ten planets.
Analyzing Solar Energy Graphs: MY NASA DATA	9-12	<ul style="list-style-type: none"> • Earth and Space Science: Atmospheric Circulation, Solar Electricity, Solar Energy, Solar Intensity and Latitude • Mathematics: Graphing and Interpreting Graphs 	Students explore data for sample locations to determine the solar radiation available for use with a solar cell.
Chemical Elements: GENESIS -- What Are We Made Of?	5-8	<ul style="list-style-type: none"> • Physical Science: Matter • Mathematics: Data Analysis and Probability 	Students study the chemical elements of the sun and learn about the essential building blocks for everything that exists, including planets and the human body.
Chemistry of Water: Mars Exploration -- Is there Water on Mars?	10-12	<ul style="list-style-type: none"> • Chemistry: Electrolysis of water; Reactions; Stoichiometry 	Students create their own electrolysis-of-water apparatus to generate oxygen.
Derivatives: Math and Science @ Work -- Space Shuttle Auxiliary Power Units	10-12	<ul style="list-style-type: none"> • Mathematics: AP Calculus AB/BC; Application of differentiation -- related rates 	This problem is an application of various calculus concepts including an application of related rates.
Distance/Rate/Time Problems: Smart Skies™	5-9	<ul style="list-style-type: none"> • Mathematics: Algebra • Physical Science 	Students use a computer-based air traffic control simulator to enact solutions to problems in real-life applications of mathematics and science.
Electrolysis of Water: Math and Science @ Work -- Breath of Fresh Air	10-12	<ul style="list-style-type: none"> • Chemistry: Electrolysis of water; Reactions; Stoichiometry 	Students create their own electrolysis-of-water apparatus to generate oxygen.
Electromagnetic Spectrum: Remote Sensing Ices on Mars	8-10	<ul style="list-style-type: none"> • Physical Science 	Students analyze data collected from visible light, infrared, and gamma rays to investigate the composition and distribution of ices on Mars.

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Engineering Design Challenge: Forces and Motion -- The Great Boomerang Challenge	9-12	<ul style="list-style-type: none"> • Engineering: Design Process • Physics and Physical Science: Aerodynamic forces 	Following the design process, students design, build and test a boomerang after conducting research on airfoils and aerodynamic forces. Then they compare their flight to how a boomerang reacts in the microgravity environment on the ISS.
Engineering Design Challenge: Lunar Plant Growth Chamber	4-8	<ul style="list-style-type: none"> • Technology: Engineering Design, Modeling • Life Science: Plant Growth 	This activity combines engineering design with plant growth whereby middle school students learn about and apply the design process to develop a lunar plant growth chamber.
Engineering Design Challenge: Spacecraft Structures	5-9	<ul style="list-style-type: none"> • Physical Science: Engineering, Transfer of Energy, Force, Mass, Newton's Laws of Motion 	The challenge is to build a model thrust structure that is as light as possible, yet strong enough to withstand the load of a "launch to orbit" three times.
Engineering Design Challenge: Thermal Protection System	8-12	<ul style="list-style-type: none"> • Science, • Mathematics • Engineering 	The challenge is to build a thermal protection system model that can withstand the heat of a propane torch.
Engineering Design Challenge: Water Filtration	9-10	<ul style="list-style-type: none"> • Earth and Space Science: Waste Water Management, Chemistry of Water, Water Cycle • Physical Science: Conductivity, Alkalinity, Mixture, Solution, Evaporation, Condensation 	Students propose and test filtration device designs, make observations, collect data, and analyze results to identify the best filter media to use.
Engineering Design: Forces and Motion -- Balloon Aerodynamics Challenge	6-12	<ul style="list-style-type: none"> • Engineering: Engineering Design Process • Science: Properties and changes of property in matter, Force and motion • Technology: Abilities of technological design, Understanding about science and technology 	Students think and act like teams of scientists and engineers as they follow the eight steps of the engineering design process to create a helium balloon system that will float at a predetermined height in the classroom.

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Engineering Design Process: On the Moon Educator Guide: Feel the Heat	7-8	<ul style="list-style-type: none"> • Physical Science: Heat Transfer, Energy Conservation, Electromagnetic Spectrum 	Students follow the engineering design process to build a passive solar hot water heater, test the design, then use test results to improve their design.
Engineering Design Process: On the Moon Educator Guide: On Target	6-12	<ul style="list-style-type: none"> • Engineering: Design Process 	Students follow the engineering design process to modify an object on a zip line; testing their performance and the results to improve their system.
Geometry: Space Math -- Solar Storms	5-12	<ul style="list-style-type: none"> • Mathematics: Geometry 	Students analyze images of a solar tsunami and use geometry and measurement skills to find the speed of the wave.
Graph Analysis: GENESIS -- Exploring Data	10-12	<ul style="list-style-type: none"> • Earth and Space Science: Origin and Evolution of the Universe • Mathematics: Data Analysis and Probability 	Students observe and record data patterns from the Genesis mission, reviewing anomalies, or divergences from the predicted values and think about questions that might arise from this study.
Graphing With MathTrax	6-12	<ul style="list-style-type: none"> • Mathematics: Equation Analysis, Graphing • Physical Science: Forces and Motion 	This free computer program helps teach students how to graph equations and datasets, or to experiment with physics simulations.
Heat, Temperature and Energy: MESSENGER -- Cooling with Sunshades	9-12	<ul style="list-style-type: none"> • Physics: Temperature, Latent Heat, State of Matter, Transfer of Energy • Mathematics: Geometry 	Students construct a simple device based on the phase change of water from ice to liquid and investigate the effectiveness of different shading materials and designs.
Heat Transfer: MESSENGER -- My Angle on Cooling	5-8	<ul style="list-style-type: none"> • Physical Science: Light, Heat, Energy • Earth and Space Science: Seasons, Solar System 	Students perform an experiment measuring the heat experienced by an object as the distance and viewing angle changes, and relate their results to the reason for the seasons on Earth.
High-Power Microscopes: The Virtual Lab	9-12	<ul style="list-style-type: none"> • Biology: Using microscopes; Using an energy-dispersive spectrometer 	This hands-on experience brings relevance to class material to inspire the next generation of explorers.

Title	Grade Level	Subjects/Topics	Description
Human Body: Space Adaptations	4-8	<ul style="list-style-type: none"> • Life Science • Mathematics: Measurement and Data 	The three activities in this lesson simulate the changes to the human body when exposed to the microgravity environment of space.
Linear Equations: NASA Connect -- Breaking Barriers	6-8	<ul style="list-style-type: none"> • Mathematics: Pre-algebra • Science: Newton's Third Law of Motion • Technology: Engineering Design Process 	Students learn about supersonic aircraft and the concept of average speed as a linear function.
Linear Regression: Exploring Space Through Math -- Space Shuttle Ascent	7-10	<ul style="list-style-type: none"> • Mathematics: Algebra 	Space Shuttle Ascent gives students a unique opportunity to analyze authentic NASA data from a space shuttle launch.
Mathematical Models: Black Holes	9-12	<ul style="list-style-type: none"> • Mathematics: Algebra • Physical Science: Forces and Motion 	Black Hole Math problems investigate black hole science and mathematics concepts, including parts of a simple black hole and calculating gravitational potential energy.
Meteorology: How Clouds Form	5-8	<ul style="list-style-type: none"> • Earth Science 	The purpose of this investigation is to facilitate understanding of the basics of cloud formation and the changing state of water.
Newton's Laws of Motion: Lunar Nautics	5-8	<ul style="list-style-type: none"> • Physical Science: Newton's Laws of Motion, Gravity, Centripetal Force 	Featured lessons are linked to exploring the moon, human presence on the moon and enabling future exploration. The lessons focus on real-world understanding of Newton's laws.
Percentage and Volume: Space Food and Nutrition -- How Much Is Waste?	5-8	<ul style="list-style-type: none"> • Mathematics: Computation, Measurement, Percentage, Volume • Physical Science: Mass, Volume 	Students compare the mass and volume of packaged food before and after it's repackaged for spaceflight to determine usable and waste portions.
Problem Solving: Transportation and Space: Reuse and Recycle	9-12	<ul style="list-style-type: none"> • Mathematics: Computation and estimation, mathematical models, measurable attributes, units and scales • Technology: Research Technologies 	Students learn to research, analyze, develop and communicate a business plan for reusing discarded man-made resources in space.

Title	Grade Level	Subjects/Topics	Description
Properties of Living Things: Fingerprints of Life	5-8	<ul style="list-style-type: none"> • Life Science: Astrobiology, Extremophiles, Metabolism 	Students conduct an experiment to find a range of tolerance for temperature extremes in samples of baker's yeast.
Properties of Living Things: Searching for Life on Mars	4-8	<ul style="list-style-type: none"> • Life Science: Properties of Life 	Students research characteristics of living organisms and develop a chart to help define important features of a living organism.
Pythagorean Theorem: Exploring Space Through Math -- Lunar Rover	8-12	<ul style="list-style-type: none"> • Mathematics: Algebra 1, Geometry 	This activity focuses on the concept of minimizing distance and time, using formulas to calculate the distance and the time for a task.
Quadratic Functions: Exploring Space Through Math -- Weightless Wonder	9-12	<ul style="list-style-type: none"> • Mathematics: Algebra 1, Geometry, Algebra 2, Pre-calculus, Algebra 2, Pre-calculus 	Students use the parabolic flight path of an aircraft to interpret graphs of quadratic functions, determine the length of time of microgravity during one parabolic segment, and the maximum altitude of the C-9 and the time when it occurs.
Radiation Biology: Ultraviolet Radiation and Yeast	9-12	<ul style="list-style-type: none"> • Biology: Effects of radiation • Life science: DNA 	This lesson demonstrates the effects of radiation on living organisms.
Skeletal System: Human Physiology in Space	9-12	<ul style="list-style-type: none"> • Life Science • Mathematics: Measurement and Data 	The two activities in this lesson focus on the effects of spaceflight on human physiology.
Temperature and Earth Climate: Modeling Hot and Cold Planets	7-9	<ul style="list-style-type: none"> • Earth Science: Climate, Weather, Solar Radiation, Energy 	The module uses science and mathematics concepts to help students explore factors affecting the habitability of planets by determining their climate.
Vector Addition: Math and Science @ Work -- Lunar Surface Instrumentation	11-12	<ul style="list-style-type: none"> • Physics: Vector Addition 	Students solve a problem involving an astronaut servicing three instruments on the flat lunar surface.

Title	Grade Level	Subjects/Topics	Description
<p>Weather and Climate: Satellite Meteorology</p>	<p>7-12</p>	<ul style="list-style-type: none"> • Earth Science: Sun-Earth System, Meteorology • Physics: Reading Graphs and Data Representations, Interpreting Data 	<p>Students use authentic data from geostationary satellites to detect and monitor forest fires and biomass burning.</p>