Journey to the Extreme: Your VIP Pass to Mars

Virtual Field Trip Activities

Grade Level: Grades 6-8
Subjects: Science, Technology, Engineering, Art, Math

Time Frame:
- Approximately 2-3 class periods for the pre-Virtual Field Trip activities
- 60 minutes for the Virtual Field Trip

Overview:
Before participating in the Virtual Field Trip (VFT), students will test their prior knowledge about Mars; become familiar with basic information about Mars through research; determine how technology plays a role in NASA's Mars Science Laboratory mission; and explore their dreams for the future.

During the VFT, students will learn first-hand about the science and technology behind NASA's Mars rover, Curiosity and its mission on Mars. Students will have the chance to participate and ask questions and walk away with a deeper understanding of the science and technology involved in getting Curiosity to Mars and landing it safely and getting information – and music – back from Mars. They will also hear from Leland Melvin, former professional football player and astronaut and current NASA associate administrator for education, about the importance of dreaming big and pursuing their passions.

After the VFT, students will apply what they learn about the science and technology of the Mars rover, Curiosity mission to a variety of STEM activities related to the various concepts that astronauts, scientists and engineers need to take into consideration when planning a mission to Mars. They will also explore how the Arts are a key element in the design process and a critical piece of innovation, as well as a way for people to express and realize their dreams.

Background for Teachers:
As educators, you promote the disciplines of science, technology, engineering, and math (STEM) with your students. STEM education is essential in order to enable students to identify the ways in which the four disciplines represented by the acronym STEM are intertwined with one another on a daily basis. STEM + Art = STEAM. By combining STEM with art and design, STEAM seeks to inspire true innovation. Both the topic and the speaker in this Virtual Field Trip provide the opportunity for you to do just that in an interesting, engaging, and accessible format for students.

This Virtual Field Trip, hosted by Leland Melvin and David Lavery, lets teachers and students embark on a study of NASA's Mars Science Laboratory mission within the context of a STEAM curriculum. In this case, the science portion focuses on the disciplines of earth/space science. This is combined with an investigation of the technology involved in sending vehicles into space and successfully landing them on other planets, using rovers to explore Mars, and transmitting a growing body of information back to Earth. The arts are addressed through design activities as well as activities focused on using music, and other media, to explore and express one's dreams.

As you lead students through the activities in the lesson, you are encouraged to help your students look for the STEAM connections that are woven throughout the Virtual Field Trip (VFT) and pre- and post-VFT activities.

Virtual Field Trip Presenters:
Leland D. Melvin, NASA associate administrator for education, is responsible for the development and implementation of education programs that strengthen student involvement and public awareness in NASA's scientific goals and missions. He leads the agency in inspiring interest in science, technology, engineering and mathematics (STEM) through NASA's unique mission, workforce, facilities, research and innovations.

Melvin received his undergraduate degree in chemistry from the University of Richmond and his Master of Science degree in materials science engineering from the University of Virginia. He began his NASA career as a research scientist at NASA Langley Research Center in Hampton, Virginia, in 1989. In 1998, he was selected to become an astronaut by NASA's Johnson Space Center in Houston. Melvin completed two Space Shuttle flights: STS-122 in 2008 and STS-129 in 2009. He flew both of his missions aboard *Atlantis* and has logged more than 565 hours in space. Prior to his graduate studies and joining NASA, Melvin was a National Football League wide receiver for the Detroit Lions and Dallas Cowboys.

David Lavery is currently responsible for two Mars Exploration missions (2008 and 2009), the design and development oversight of the next generation of robotic Mars exploration spacecraft, the NASA Astrobiology Field Laboratory, and the Mars Advanced Technology Program. For over a decade, Mr. Lavery led NASA's Telerobotics Technology Development Program, with responsibility for content and direction of robotics and planetary exploration research efforts. Under his leadership the program was transformed into a world-class robotics technology and systems development program impacting NASA flight programs, other government robotics projects, and the entire robotics industry. Mr. Lavery's current professional commitment and involvement includes the creation of the NASA Robotics Alliance

Project (RAP) to inspire K-12 students in robotics and serving as a National Executive Advisory Board member of FIRST Robotics.

Pre-VFT Activities (Engage):

1. What Do You Know about Mars?
   - Write the word Mars on the board and give students 1-2 minutes to brainstorm (write down or draw) everything that comes to mind when they think about Mars.
   - Use the following quiz as an anticipatory guide on Mars. For each of the questions, students should answer Fact or Fiction.
   - Option: You may choose not to reveal the answers and revisit the questions as a post-Webinar activity that can be used as an assessment.

   Mars: Fact or Fiction? Quiz

   1. Ancient rivers once meandered across Mars' surface. (Fact)
   2. Ancient Romans, Egyptians and Babylonians recognized Mars as a planet. (Fact)
   3. Of the eight known planets, Mars is the fourth largest. (Fiction; it's the second smallest)
   4. Mars has two moons within its gravitational pull. (Fact)
   5. NASA's fastest trip to Mars has taken about three months. (Fiction; it's taken about twice that long.)
   6. In winter, nighttime temperatures on Mars can drop as low as -191 degrees Fahrenheit. (Fact)
   7. In 1938, a radio theater presentation of a book about Martians invading Earth caused widespread panic. (Fact)
   8. Like Earth, the poles of Mars are covered in ice. (Fact)
   9. Mars is known as the "Red Planet" because its surface is red. (Fiction; it's actually the color of butterscotch pudding.)
   10. Mars has about the same land area as Earth. (Fact)
   11. The Martian "day" is about half as long as a day on Earth. (Fiction; it's about half an hour longer.)
   12. The Valles Marineris, a system of canyons on Mars, is the largest rift system in the Solar System. (Fiction; Earth's Rift Valley and Baltis Vallis on Venus are larger.)
   13. One of Mars' moons is moving closer to Mars and scientists think that one day it will crash into Mars. (Fact)
   14. Mars is named for the ancient God of War. (Fact)

2. Mars' Surface
   - Ask students what the surface of Mars looks like. Accept all answers.
   - Break students into pairs or small groups and assign each group one of the following Martian landforms to research:
     - impact crater
     - volcano
     - river valley
     - river bed
     - dry lake bed
     - polygonal ground
     - lava flow
     - sand dune
     - fractures
     - wind streaks
   - Have each group present its landform to the class as a whole. Presentations should include at least one image of the landform.
   - Discuss which of these landforms is present on Earth. Invite students to consider how familiarity with these landforms might help NASA scientists working on a mission to land a rover that can study the Martian environment and transmit data back to Earth.
   - Have students create models of Mars' surface to familiarize themselves with the obstacles NASA has had to overcome during its Mars Science Laboratory mission.

   Extension:
   - Have students further investigate the surface of Mars through the creation of impact craters.
   - Divide students into small groups and give each group a cake pan (13 x 9") with flour and balls of various sizes. Fine red sand can be used to spread a thin layer over the flour to represent the "red planet."
   - Have students drop the balls onto the pan from a height of two feet.
   - Students should measure the width of the crater and the length of the splatter from each ball.
   - Students can then research the various craters on Mars, determine why Mars has so many craters, and compare the number of craters on Mars to the number on Earth, which has far fewer.

3. You've Got to Design It!
   - Explain to students that NASA's Curiosity rover is a mobile science laboratory designed to search areas of Mars for past or present conditions favorable to life, and conditions capable of preserving a record of life.

- Have students work in small groups to design their own Mars rover. Students can create visual designs or build their rovers using materials they deem suitable. (Legos or other building sets with interlocking pieces may be the best options.)
- Students should incorporate the following principles in their designs:
    - It must be able to move around. Optional: It must have a way to right itself if it tumbles over on rugged terrain.
    - It must have an apparatus for picking up items to "analyze."
    - It must have a way generating the electricity it needs to run.
    - It must have a way to receive and transmit information.
    - It must have a way to capture images.
    - It must have a way to measure temperature.
- When students have completed their designs, have each group present its design to the class.
- Students can vote on the best rover and/or create a class design that incorporates the best features of various groups' designs.
- Have students visit NASA's website (http://mars.jpl.nasa.gov/msl/mission/rover/) to learn about the technology and design behind the Curiosity rover.

4. Just How Do They Get That Off the Ground?
    - Explain to students that they are going to investigate the problem of propulsion, which scientists from NASA must solve to get a rocket or spaceship into space.
    - Divide students into small groups and provide each group with the following materials: a small plastic car, a variety of balloons, masking tape, a 6-foot piece of string (kite string thickness), and a 2-inch piece of drinking straw.
    - Explain to students that the goal is to figure out how to get the balloon to carry the small plastic car from the floor to the top of the 6-foot string.
    - Ask for three volunteers to help demonstrate the basics: One student must first blow up a balloon and hold the end closed. A second student must then tape the 2-inch piece of straw to the one side of the balloon and the small plastic car to the other side of the balloon. A third student will step on one end of the string to anchor it to the ground. The second student will place the kite string through the 2-inch piece of straw while the first student keeps hold of the end of the balloon to keep the air in. The third student should hold up the end of the string in a straight line perpendicular to the ground. The student holding the balloon will then let go and the balloon will move up the string. The goal is to get the balloon to go as high up the string as possible.
    - Students should replicate the process in their small groups. After their first attempt, they should discuss possible ways to get the balloon to go higher (use a bigger balloon, blow up the current balloon even bigger, use a different shape balloon, etc.).

- Allow time for each group to complete three trials. For each attempt, they should take notes on their approach and results.
- Have a class discussion about what students learned needed to be done in order to be successful.
- Introduce the concept of propulsion and provide a definition (e.g., the process of driving an object forward). Ask students how this concept applies to the experiment they just conducted.
- Ask how the concept of propulsion might apply to the work of NASA. Explain that NASA scientists need to apply this principle in order to give their spaceships enough boost to break free from the gravity of Earth.

5. <u>Reach for the Stars</u>
   - Share with students the following quote from President John F. Kennedy's famous 1962 Moon speech: "We choose to go to the moon. We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard."
   - Ask students what they think this quote means. Discuss possible interpretations. Guide students to understand that sometimes the greatest rewards come from the most difficult challenges.
   - Ask students to brainstorm at least five things they would like to accomplish in their lives and rank them from easiest to most difficult.
   - Have students pick one goal at the hard end of the spectrum and write down 3 actions they can take to help them achieve that goal.
   - Ask students to share their responses with a partner or small group.
   - Explain that during the Virtual Field Trip students will learn about how the speaker dared to dream big and worked hard to achieve his goals. Provide students with a brief biography of Leland Melvin.
   - As a class, compile a list of questions students would like to pose to the presenter regarding his personal journey and his advice on achieving one's goals.

Virtual Field Trip (Explore)

- Participate in the Virtual Field Trip (VFT) together. If you are watching live, it will likely take about an hour.
- Ask students to pass in their questions/points of interest for the speakers. Submit your questions via the chat function on Livestream . These questions can also be used after the VFT for subsequent discussion.
- Encourage students to actively listen and jot down additional questions they may have as well as facts they learn about NASA's Mars mission and Mars in general.

- Ask them to pay particular attention to the presenters' descriptions of the technology and science behind the Mars mission to help with post-VFT activities!

About i.am.STEAM
i.am.STEAM is a revolutionary youth engagement initiative that brings science, technology, engineering, art and math education to life for students nationwide – inspiring and cultivating the next generation of problem solvers, innovators and leaders.

About i.am.angel foundation
will.i.am launched his private foundation in 2009 (formerly known as i.am angel foundation, presently known as i.am.giving foundation) around the idea of providing assistance to needy students wanting to attend college through a program entitled "i.am scholarship." In 2012, in response to individuals, corporations, and funders expressing interest in supporting similar charitable activities, will.i.am created "i.am.angel foundation", which is seeking public charity status with the appropriate taxing authorities. The foundation will be striving to trans4m lives through education, inspiration and opportunity, including by providing funding for other charitable activities, such as i.am.College Track, i.am.scholarship, i.am.STEAM and i.am.home. To learn more, please visit www.iamangelfoundation.org.

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