EDUCATION @ MESA ARTS CENTER

NATIONAL GEOGRAPHIC LIVE!
TERRY VIRTS: VIEW FROM ABOVE

Ikeda Theater | October 19 | 10:15 AM | Grades: 5 - 8

2017/2018 EDUCATOR RESOURCE GUIDE

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ABOUT TERRY VIRTS, NASA ASTRONAUT…

National Geographic Live! brings you Terry Virts, a NASA astronaut who has found a unique perspective during his time at the International Space Station (ISS). Virts began his career as a pilot with the US Air Force, but joined NASA as a pilot in 2000. Due to NASA becoming more cautious about going into space in the early 2000's, it was difficult for astronauts to make it on to an expedition into space. However, Virts persevered and made it into space in 2010. Several years later he took his first trip to the ISS and was able to experience space firsthand. During his time on the ISS, Virts helped install the Cupola module which gave astronauts a 360 degree view of space from the station.

While in space, Virts also discovered his love for photographing the Earth. After spending over 200 days in space, Terry Virts now holds the record as the person who has taken the most photographs of Earth from space, many from the Cupola module he installed. His amazing photographs are captured in the National Geographic book *View From Above* as well as the IMAX film *A Beautiful Planet*. During this National Geographic Live! presentation you will hear from Terry Virts about his incredible experiences in space as well as see many of these unbelievable photos taken from space.

EDUCATION @ MESA ARTS CENTER

WELCOME!

Dear Educator,

Thank you for selecting a **National Geographic Live!** field trip with the Mesa Arts Center. We have a dynamic season planned and we look forward to connecting you to our many speakers and presentations. With National Geographic Live, students are able to experience dynamic presentations and make educational connections well beyond the classroom.

We also recognize and appreciate the energy and time spent on your part in coordinating field trips. In this guide we have provided information to help make this the best experience possible.

In addition, the Mesa Arts Center has many open and inviting spaces that make good places to hold a brown bag lunch. Prior arrangements for lunch accommodations need to be made by either calling (480) 644-6540 or emailing outreach@mesaartscenter.com.

Please contact our offices should you have any additional questions (contact info on last pg.).

Enjoy the show!

TEACHER AND CHAPERONE INFORMATION

Chaperones

- Assign each chaperone a designated group of students and provide him/her with a written list of the students in that group.
- Ask chaperones to stay with their assigned group throughout the field trip. Adult chaperones are responsible for the students' conduct and behavior throughout their visit to the Center.
- Please review theater etiquette rules and responsibilities with all chaperones.
- Have the phone numbers of every chaperone in your group to quickly access each other in case of emergency.

Theater Etiquette

- No Food or Drink inside the theatre (besides bottled water).
- Students must be accompanied by chaperones at all times.
- Cameras and recording devices may not be used during the performance.
- Please silence cell phones and resist the urge to text message.
- Listening and following the House Managers and Ushers will help the seating and dismissal process.
- Feel free to laugh, clap and enjoy the show but also to be respectful of those around you.

CURRICULUM CONNECTIONS

National Geographic Live: Terry Virts: View From Above

Arizona's College and Career Ready Standards

These standards can be achieved by using the discussion questions included in this guide.

Speaking and Listening

Grades 5-8.SL.1 — Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

Grades 5-8.SL.2 — Ask and answer questions about key details in a text read aloud or information presented orally or through other media.

Science

Grades 7 & 8: SC-S2C1-04 — Evaluate career opportunities related to life and physical sciences.

Grades 5-7: SC-S2C2-01; SC08-S2C2-02 — Describe how science is an ongoing process that changes in response to new information and discoveries.

Grades 6-8: SC-S2C31-03 — Analyze or evaluate the impact of a major scientific development occurring within the past decade.

Arizona's College and Career Ready Standards

These standards can be achieved by using the STEAM lesson included in this study guide.

Math

5.MD.A.1 — Convert among different-sized standard measurement units within a given measurement system, and use these conversions in solving multi-step, real-world problems.

6.RP.A.3 — Use ratio and rate reasoning to solve mathematical problems and problems in real-world context.

7.RP.A — Analyze proportional relationships and use them to solve mathematical problems and problems in real-world context.

7.G.A.1 — Solve problems involving scale drawings of geometric figures, such as computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

Mathematical Practice 1 — Make sense of problems and persevere in solving them.

Mathematical Practice 2 — Reason abstractly and quantitatively

Mathematical Practice 6 — Attend to precision.

CURRICULUM CONNECTIONS CONTINUED

National Geographic Live: Terry Virts: View From Above

Arizona's College and Career Ready Standards

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Science

Strand 1 of the Science standards lays out the Inquiry process for students in grades 5-8. Performance objective details vary by grade but the general goals of each Concept are below:

SC-S1C1 — Observe, ask questions, and make predictions.

SC-S1C2 — Participate in planning and conducting investigations, and recording data.

SC-S1C3 — Organize and analyze data; compare to predictions.

SC-S1C4 — Communicate results of investigations.

Additionally these standards support the Engineering Design Process:

Grade 5:

SC05-S3C1-02 — Propose a solution, resource, or product that addresses a specific human, animal, or habitat need.

SC05-S3C1-03 — Evaluate the possible strengths and weaknesses of a proposed solution to a specific problem relevant to human, animal, or habitat needs.

SC05-S3C2-03 — Design and construct a technological solution to a common problem or need using common materials.

Grades 6-8:

SC-S3C2-01— Propose viable methods of responding to an identified need or problem.

SC-S3C2-02 — Compare possible solutions to best address an identified need or problem.

SC-S3C2-03 — Design and construct a solution to an identified need or problem using simple classroom materials.

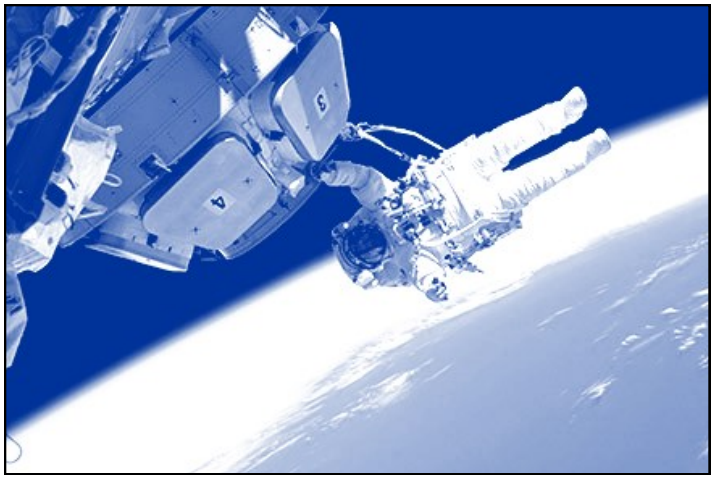
Speaking and Listening

Grades 5-8.SL.4 — Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.

21st Century Learning Skills

By using the STEAM lesson included in this guide, students can become more proficient in the following Competencies:

- **Critical Thinking**
- **Creativity**
- **Communication**
- **Collaboration**



DISCUSSION QUESTIONS

Pre-Performance Discussion Questions

Terry Virts says life in space is pretty cool since they have everything they need, the food is good, and he is with good friends. Would you like to travel into space? Why or why not?

In one of the recent missions to the International Space Station (ISS), one of the goals was to prepare the ISS for the arrival of future vehicles, including private spaceships. What do you think about space tourism? How might this change how space exploration is viewed and executed?

Terry Virts was a pilot in the United States Air Force before becoming a NASA pilot and astronaut. What characteristics make a good astronaut?

Post Performance Discussion Questions

What was something surprising or interesting you learned from Terry Virts' presentation on space?

In what ways did Terry Virts demonstrate curiosity, responsibility, empowerment, and persistence in his work? Why do you think these attitudes are important for explorers?

Did Terry Virts make any call to action to support his work? Are there any changes we can make in our day to day lives to support the Earth or space exploration? What can we work on together as a group?

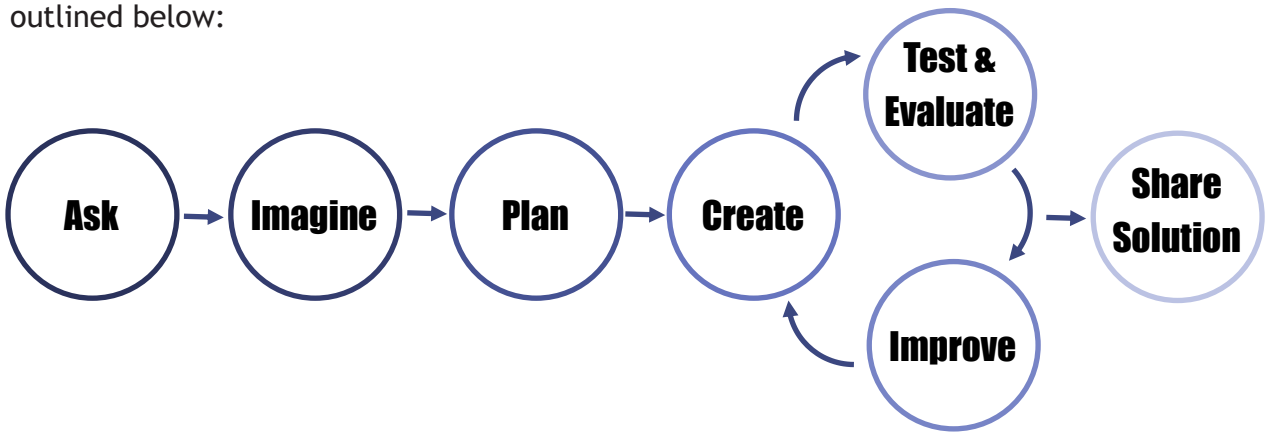
WHAT IS STEM?

STEM is a common buzzword in education these days, so it is important to know what exactly STEM is, and also what it is not. A true STEM lesson not only incorporates different subject areas, but also works to develop students' abilities to think creatively, reason, investigate, and work as a team. Here is a breakdown of what STEM means:

S Science	T Technology	E Engineering	M Math
The study of the natural world.	While traditional digital technology meets this part of STEM, technology is any product made by humans to meet a want or need. Any product created by students to solve a problem can be considered technology.	The design process students use to solve problems.	The study of numbers, equations, functions, and geometric shapes and their relationships.

A science experiment is not necessarily a STEM lesson. The requirements below need to be met as well for a lesson to be STEM based learning:

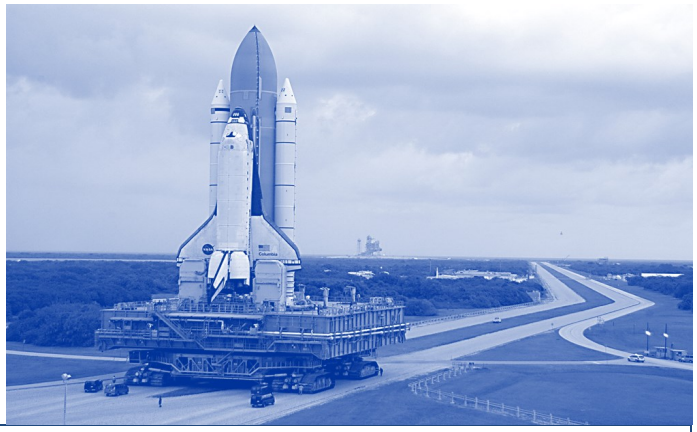
- The lesson focuses on a real world problem/issue.
- Students are working in productive teams.
- Students are engaging in hands-on inquiry and open-ended exploration. Students should be able to redesign as needed (within time constraints) so there should not be an exact end product/result predetermined by the teacher in mind.
- Students understand that there are multiple right answers to the posed problem and that failure can be used to reevaluate and make changes towards discovering a solution.
- The lesson uses the *engineering design process (EDP)*. EDP is similar to the scientific method and is outlined below:



- Adding any type of art component to the lesson changes STEM to STEAM.

STEM LESSON: LIGHT BUT STRONG

Terry Virts trained on Earth for a long time before he was ready to go into space. Similarly, engineers and scientists for NASA have to make many preparations and structures on Earth for a trip into space to be successful. In this STEM lesson, students will create a simulation of a mobile launcher platform that can hold the weight of a rocket (a cup) and several astronauts (pennies) without collapsing.



ASK (REAL WORLD PROBLEM)	Preparing to go into space requires a team of engineers and scientists working together. One of these engineers is a materials engineer. The job of this type of engineer is to use strong, lightweight, heat resistant materials to create spacecraft or launch pads. One important construct they make is a mobile launcher platform. These platforms need to be strong enough to hold a rocket, but light enough to be able to transport the rocket. This can be a tricky balance to achieve. Ask students, "Can you create a structurally sound mobile launcher platform that can support the weight of a rocket (in the form of a cup) and astronauts (in the form of pennies)?
MATERIAL POSSIBILITIES	Students will need a variety of materials to choose from to create their mobile launcher platform. The platform should be at least 6" high so for the walls/sides of the platform straws and popsicle sticks would work best. Offer a variety of connecting materials such as tape, clay, or playdoh. Students can use the clay or playdoh as part of their walls but remind them that the platform needs to be moveable and lightweight. You will also need a 3"x 3" cardboard square, a small paper or styrofoam cup, and at least 15 pennies for the testing portion of this lesson.
IMAGINE & PLAN	After students have been grouped and presented with the problem, they will need to brainstorm and sketch ideas for their platform. Show students the materials available so they can plan accordingly. Things to consider when designing your platform: Will this platform be moveable without falling apart? What supports are you using to keep the platform from collapsing when weight is added? Does your platform meet the 6" height requirement? Students should sketch out their final platform design (to scale if possible) before moving on to the create stage.

Summarized from a NASA lesson at: https://www.nasa.gov/sites/default/files/atoms/files/lightbutstrong_web.pdf

STEM LESSON: LIGHT BUT STRONG

CREATE	After presenting their design sketch to their teacher, students can begin building their platform. While building the platform students may run into some unexpected difficulties with connecting their materials or having materials stand up on their own. If necessary groups should be encouraged to revise sketches or improve as needed in the moment. Straws can also be cut to different sizes as needed although popsicle sticks are more difficult to change. Do caution students to stop and discuss if they are running into a lot of problems so they can plan a solution without wasting a lot of materials. If you are incorporating art into this lesson to make it a STEAM lesson, offer students artistic materials to add their personal aesthetic flair to their platform model. A time limit of 20 to 30 minutes to create models should be sufficient.
TEST, EVALUATE, & IMPROVE	After the time limit is up, have groups bring their models to the front of the room to be tested. The platforms should be mobile so they should be able to move the platform without it falling apart. For each group's turn, place the cardboard square on top of the platform followed by the rocket in the form of a cup. If the platform remains stable, add an astronaut (penny) one at a time until the platform collapses (or you run out of pennies). Record how many astronauts each platform was able to support. If time allows students could have time to improve their platform based on what happens in the test.
SHARE SOLUTIONS	Once the platform models have been tested, evaluated, and improved if possible, students can discuss their final products as a class. The class can discuss any factors that may have contributed to the success or failure of each platform model.

LITERACY CONNECTIONS

- *Students can write an informative paragraph or essay detailing the specifics of their mobile launcher platform. They can include their reasoning behind design choices.*
- *Students could also write a research report on an astronaut or spacecraft. The NASA website has many resources and articles available for all age ranges of students.*

Summarized from a NASA lesson at: https://www.nasa.gov/sites/default/files/atoms/files/lightbutstrong_web.pdf

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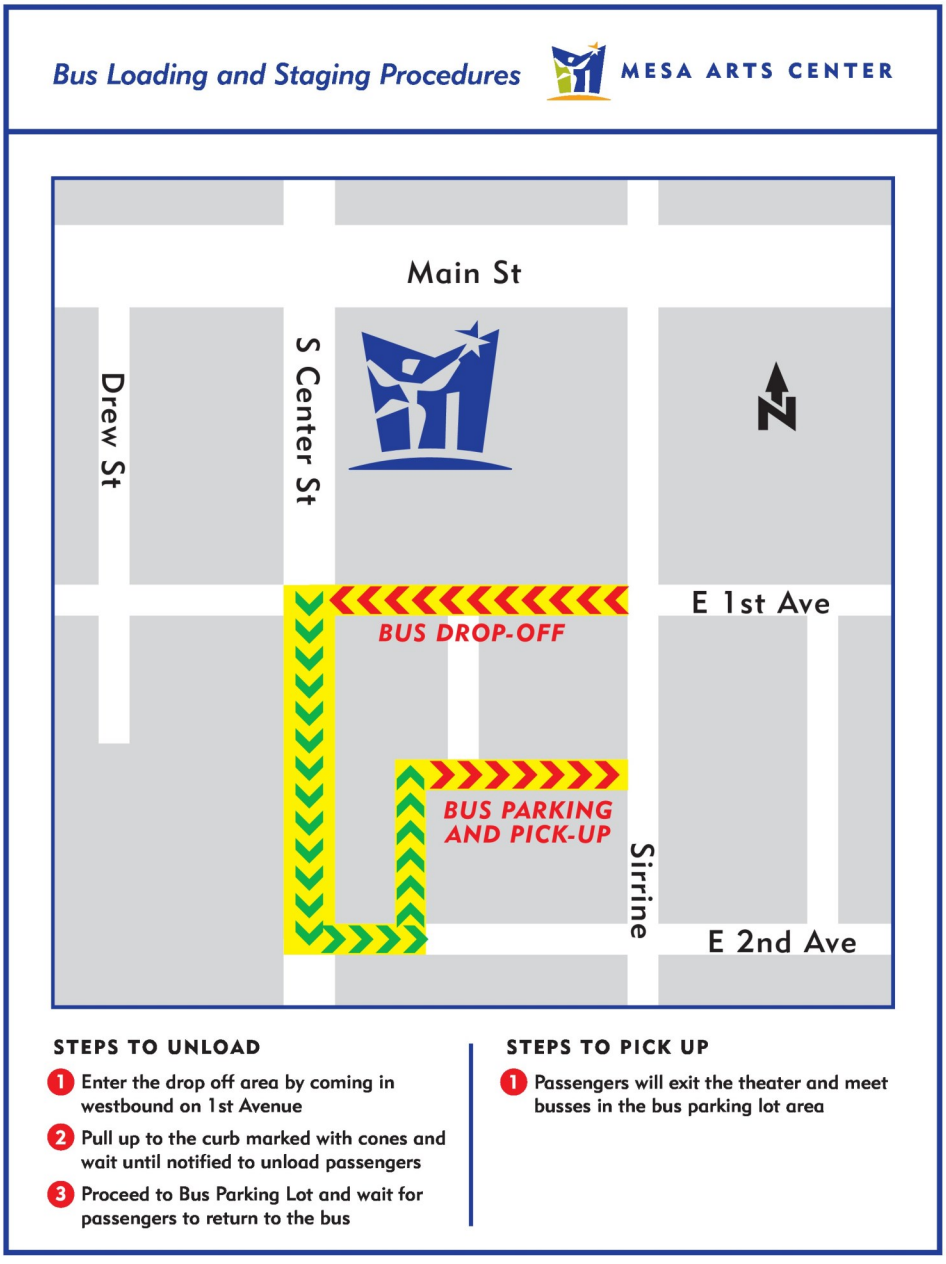
MESA ARTS CENTER MAP



PLEASE NOTE - We ask that buses arrive approximately 30 minutes before the performance begins to allow ample time to unload and seat students.

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THANK YOU!

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