



Breaking Boundaries in Space

Objectives

Students will:

- Explore how space unites and inspires people from all backgrounds.
- Understand it takes a team of talented people to travel to and live in space.
- Research people from diverse backgrounds who contributed to space exploration.
- Create an original, 2-dimensional piece of art using students' choice of media.

Suggested Grade Level

PreK – 12th

Subject Areas

Language Arts, Art, History

Timeline

60+ minutes

Standards

English Language Arts Standards

- CCSS.ELA-LITERACY.RI.K-12.1-10: Reading for informational text
- CCSS.ELA-LITERACY.RST.6-12.2: Reading for science and technical subjects

Visual Arts Standards

- Anchor 1: Generate and conceptualize artistic ideas and work
- Anchor 2: Organize and develop artistic ideas and work
- Anchor 3: Refine and complete artistic work

21st Century Essential Skills

- Learning Skills (critical thinking, creativity, communication)
- Literacy Skills (information, media, technology)
- Life Skills (flexibility, initiative, productivity, global awareness, listening)

Background

Space unites and inspires people around the globe. Exploring the moon, Mars, and beyond requires the talents and teamwork of people from every background. Space travel has and will always bring people together around a common mission. It ignites a passion to explore, a desire to learn, and an excitement that eliminates any boundaries of race, nationality, creed, or culture.

Throughout history, many people have contributed to space exploration. In accordance with the Outer Space Treaty of 1967, outer space is free for exploration by all States. It also states that “the exploration and use of outer space shall be carried out for the benefit and in the interests of all countries and shall be the province of all mankind.”



With each successive mission into space, more boundaries were shattered. From the first dog in space, first human in space, first spacewalk, first joint mission, first woman in space, first African American in space, all the way to where we are today with 20 years of continuous human presence aboard the International Space Station.

As of November 2, 2020, the International Space Station (ISS) has had humans living and working continuously testing technologies, conducting scientific research, and developing skills needed to explore farther from Earth. It is an excellent example of the collaboration of space agencies. An international partnership of five space agencies from 15 countries operates the International Space Station. The Boeing Starliner astronauts headed to the ISS are blazing a new trail of innovation and discovery.

Additional space missions are focused on heading back to the moon and beyond. The astronauts on NASA's Artemis Team come from a diverse range of backgrounds, expertise, and experience. The goals of NASA's modern lunar exploration program are to land the first woman and next man on the Moon in the mid-2020s and establish a sustainable human presence on the Moon by the end of the decade.

Vocabulary

International Space Station, Outer Space Treaty, boundaries, diversity, race, nationality, creed, culture

Materials

- Access to the internet
- Art supplies (paint, paintbrushes, crayons, markers, paper/canvas, etc.)
- Optional: graphic design application

Engage

- Bring students' attention to the first box on the "think sheet" labeled 'Moonshot thinking'. Let them know that they are going to be watching a short video called 'Moonshot thinking'. Their job is to write down any words or ideas that they find inspiring or interesting while watching the video. (See Lesson Resources)
- Give students a minute after the video to write or draw any other thoughts they have about the video.
- Have students turn and talk to discuss their key takeaways from the video about what they think it means to 'break boundaries'.

Explore

- Inform students that today they are going to go on an adventure to learn about what it means to be a space pioneer. They will explore some examples of people that have broken boundaries in space. At the end they will be able to create a piece of artwork to represent one space pioneer that inspired them!



- Students will make choices within a hyperlinked google slides document to explore space pioneers from diverse backgrounds in a variety of space industries. (See Lesson Resources)
- Students should take notes on the think sheet to record the path that they end up taking. They will also write down interesting facts about the space pioneers they learn about!

Explain

- As students take notes and discover information about a space pioneer, pause to reflect on the questions on the worksheet.
 - How did your space pioneer impact space exploration?
 - Why is it important for space exploration to work with various nations and people of diverse backgrounds?
- After students reflect and write down their thoughts individually, they can share with a partner. Lead a discussion that highlights the importance of working within a diverse team to accomplish challenging missions in space.
 - Suggestions for conversation:
 - Highlight how different each space pioneer is (where they come from, what they do, etc.).
 - Point out how international collaboration was necessary to meet complex space goals such as assembly of the international space station.

Elaborate

- Students may continue to use the Google Slides document or do their own research to learn about different space pioneers until they find one that inspires them.
- Show students the art showcase entry prompt and requirements.
 - <https://artshowcase.spacefoundation.org/>
- Have them sketch a plan for a piece of artwork that shows how that person broke boundaries in space.
 - If students are stuck, ask prompting questions such as, ‘What did they accomplish in space?’, or ‘Were they the first to do something?’.

Evaluate

- If time allows, have students create their piece of artwork to be submitted to the Art Showcase in class. Students can also take their sketch home and finish their artwork there.
 - Artwork requires parent/guardian permission to be submitted.
- Once students have completed their artwork, give students the opportunity to ask questions and give feedback on their peer's artwork by participating in a gallery walk.
 - A gallery walk is when students walk around as if in an art gallery and observe their classmates work. You can use sticky notes to allow students to leave positive feedback by their peers finished product.



Lesson Resources

Moonshot Thinking Video: <https://www.youtube.com/watch?v=pEr4j8kgwOk>

Link for choose your own adventure slides:

https://docs.google.com/presentation/d/1fvxnWV7iThYo6t9RpPQ_Mtx3aNRVC_XGPYZtzuNFxIA/copy



Breaking Boundaries in Space Think Sheet

Warm-Up

Moonshot Thinking

Write or draw any key words or thoughts from the video.

Choose Your Own Adventure

I decided to (go to space / stay on Earth)

I am exploring someone with the career of _____

My space pioneer is _____

Impacts on Space:

Interesting Facts



Reflection

Why is it important for space exploration to work with various nations and people of diverse backgrounds?

Sketch

Draw a plan to represent a space pioneer that inspires you!



Extensions

1. Write a paragraph(s) describing the artwork and how it depicts the theme.
2. Write an essay answering the following questions:
 - a. What did the person researched do to change or enhance space exploration?
 - b. How has this person inspired you?
3. Have older students listen to the podcast on Roda Ahmed, author of "Mae Among the Stars." How did Mae Jamison inspire Roda? How has Roda inspire other students?
Link: <https://www.bushcenter.org/publications/podcasts/channels/strategerist/index.html>
4. Watch the Artemis Astronaut profile videos.
<https://www.youtube.com/playlist?list=PL2aBZuCeDwlQqwFjezU4wJMqK11qpNpR->
5. Read "Mae Among the Stars" to younger students. Ask students, "How did Mae break the boundaries? What are some ways YOU could break the boundaries?"
6. Visit <http://www.discoverspace.org/>, <https://www.boeingfutureu.com/>, and <https://www.discoveryeducation.com/> for more innovative ideas and resources.

References

Ahmed, R., & Burrington, S. (2018). Mae among the stars. New York, NY: Harper, HarperCollins.

Alexander, K. L. (2019) Mae Jemison. National Women's History Museum.
<https://www.womenshistory.org/education-resources/biographies/mae-jemison>

Archuletta, H. (2019, June) Women of the Space Agency: Once Forbidden, no Longer Hidden. PBS. <https://www.pbs.org/independentlens/blog/women-of-the-space-agency-once-forbidden-no-longer-hidden/>

The Artemis Team. (n.d.). Retrieved from <https://www.nasa.gov/specials/artemis-team/>

BESE. (2018, December 24). Hidden Figuras: Mary Golda Ross. [Video] Youtube.
<https://www.youtube.com/watch?v=ee18wIJm04Y>

Biography. (2018, February). Mae Jemison: First African American Woman in Space. [Video]. Youtube. <https://www.youtube.com/watch?v=rWxGAogqr4M>

Biography. (2013, August). Sally Ride- The First American Woman in Space. [Video] Youtube, <https://www.youtube.com/watch?v=RD6vzRd0rhY>

Brown, K. (2020, October 26). Astronauts in Space to Discuss 20th Anniversary of International Space. Retrieved from <https://www.nasa.gov/press-release/astronauts-in-space-to-discuss-20th-anniversary-of-international-space-station>



Capaldi, E. (2017, September). *What is Moonshot Thinking*. [Video]. Youtube.
<https://www.youtube.com/watch?v=pEr4j8kgwOk>

Castellanos, A. (2021, December). Arnaldo Tomayo Méndez: First Latin American in Space. Spanish Academy. <https://www.spanish.academy/blog/arnaldo-tamayo-mendez-first-latin-american-in-space/>

CBSDFW. (2018, February). 15 Years Since Columbia Disaster UTA Remembers Kalpana Chawla: One of Their Own. [Video] Youtube. <https://www.youtube.com/watch?v=cV5UDODtOXs>

Charles Bolden Facts for Kids. Kiddle Encyclopedia.

Ciampaglia, D. (2017, December). 10 Questions for Jessica Watkins. Time for Kids. <https://www.timeforkids.com/g34/10-q-jessica-watkins/>

Creating. (n.d.). Retrieved from <https://www.nationalartsstandards.org/>

DJI. (2015, December 22). DJI Profiles- From NASA to the Phantom. [Video] Youtube. <https://www.youtube.com/watch?v=DBvrKUtna9E>

Ducksters. (2022). Biography: Sally Ride for Kids. Ducksters. Retrieved from https://www.ducksters.com/biography/women_leaders/sally_ride.php

Facts Just for Kids. (n.d) Mae Jemison Facts for Kids. Facts Just for Kids. <https://www.factsjustforkids.com/space-facts/astronaut-facts-for-kids/mae-jemison-facts/>

Ellison Onizuka Facts for Kids. Kiddle Encyclopedia.

Garcia, M. (2015, March 25). International Cooperation. Retrieved from https://www.nasa.gov/mission_pages/station/cooperation/index.html

Garcia, M. (2015, January 12). International Space Station. Retrieved from https://www.nasa.gov/mission_pages/station/main/index.html

Jessica Watkins Facts for Kids. Kiddle Encyclopedia.

Kalpana Chawla Facts for Kids. Kiddle Encyclopedia. Accessed September, 2022. https://kids.kiddle.co/Kalpana_Chawla

Katie Bouman Facts for Kids. Kiddle Encyclopedia. https://kids.kiddle.co/Katie_Bouman



Lange, K. (2020, January). Face of Defense: To the Moon... And Beyond!. U.S. Department of Defense. <https://www.defense.gov/News/Feature-Stories/story/Article/2058515/face-of-defense-to-the-moon-and-beyond>

Margaret Hamilton (scientist) Facts for Kids. Kiddle Encyclopedia.

Mary Golda Ross: The First Native American Aerospace Engineer and Space Race Pioneer. (n.d.). Retrieved from <https://www.amightygirl.com/blog?p=26040>

Mattock, R. (2021, November 19). Classified- Read Aloud. [Video] Youtube. https://www.youtube.com/watch?v=ZdmH_D_qxE

NASA. (n.d.). Apollo Image Gallery. NASA. https://www.nasa.gov/mission_pages/apollo/images.html

NASA Johnson. (2018, August). Astronaut Moment: Serena Auñón-Chancellor. [Video] Youtube. <https://www.youtube.com/watch?v=erGhlf55IVE>

NASA. (n.d.) Astronaut Stephanie Wilson. Flickr. <https://www.flickr.com/photos/nasa2explore/albums/72157663034676443>

NASA (2004, May). Biographical Data. https://www.nasa.gov/sites/default/files/atoms/files/chawla_kalpana.pdf

NASA. (2007, January) Biographical Data. NASA. https://www.nasa.gov/sites/default/files/atoms/files/onizuka_ellison.pdf

NASA. (n.d.) Biographical Data, Marsha S. Ivins. NASA. https://www.nasa.gov/sites/default/files/atoms/files/ivins_marsha.pdf

NASA (n.d.).Black Holes: By the Numbers.Jet Propulsion Laboratory. <https://www.jpl.nasa.gov/edu/learn/slideshow/black-holes-by-the-numbers/>

NASA. (2017, January). Charles Bolden: Past 8 Years. [Video] Youtube . <https://www.youtube.com/watch?v=Uw8E26uS6Xs>

NASA/JPL-Caltech/ASU/MSSS. (2022, April). How Perseverance Drives on Mars. NASA Science Mars Exploration Program. <https://mars.nasa.gov/resources/26660/how-perseverance-drives-on-mars/>



NASA. (2009, June). In Their Own Words: Serena M. Aunon. NASA.
https://www.nasa.gov/astronauts/2009_aunon.html

NASA. (2022, June). Jasmin Moghbeli (Lt. Col., Marine Corps) NASA Astronaut. NASA.
<https://www.nasa.gov/content/jasmin-moghbeli-lt-col-us-marine-corps-nasa-astronaut>

NASA. (2022, April). Jessica Watkins (Ph.D.) NASA Astronaut. NASA.
<https://www.nasa.gov/content/jessica-watkins-phd-nasa-astronaut>

NASA (n.d) Katherine Johnson Legacy. From Hidden to Modern Figures.
<https://www.nasa.gov/modernfigures/videos>

NASA. (2020, December). Meet Artemis Team Member Jessica Watkins. [Video]. Youtube.
https://www.youtube.com/watch?v=jo-TeN2_lxE&t=143s

NASA. (2020, December). Meet Artemis Team Member Jasmin Moghbeli. [Video]. Youtube.
<https://www.youtube.com/watch?v=NcMCxIbPyws&t=2s>

NASA (2015, November 24). NASA Mathematician, Recipient of Nations Highest Civilian Honor. [Video] Youtube. <https://www.youtube.com/watch?v=bLgzHutK1wo&t=66s>

NASA. (2019, October). Serena M. Aunon-Chancellor. Astronaut Biography.
<https://www.nasa.gov/sites/default/files/atoms/files/aunon.pdf>

NASA (2008, August 26). She Was a Computer When Computers Wore Skirts. NASA History.
https://www.nasa.gov/centers/langley/news/researchernews/rn_kjohnson.html

NASA. (n.d.) Showing results for "Charles F. Bolden". NASA Image and Video Library.
<https://images.nasa.gov/searchresults?q=charles%20F.%20Bolden&page=1&media=image,video,audio&yearStart=1920&yearEnd=2022>

NASA. (n.d.) Showing results for "Mae Jemison". NASA Image and Video Library.
<https://images.nasa.gov/searchresults?q=Mae%20Jemison&page=1&media=image,video,audio&yearStart=1920&yearEnd=2022>

NASA. (n.d.) Showing results for "Marsha Ivins". NASA Image and Video Library.
<https://images.nasa.gov/searchresults?q=Marsha%20Ivins&page=1&media=image,video,audio&yearStart=1920&yearEnd=2022>



NASA. (2018, December). Peggy A. Whitson (PH.D.) NASA Astronaut. NASA.
<https://www.nasa.gov/astronauts/biographies/peggy-a-whitson/biography>

NASA. (n.d). Showing results for "Serena Aunon". NASA Image and Video Library.
<https://images.nasa.gov/searchresults?q=Serena%20Aunon&page=1&media=image,video,audio&yearStart=1920&yearEnd=2022>

NASA (2022, January). Stephanie D. Wilson NASA Astronaut. NASA.
<https://www.nasa.gov/astronauts/biographies/stephanie-d-wilson/biography>

NASA Johnson. (2015, March). Astronaut at a Glance: Sunita Williams. [Video] Youtube.
<https://www.youtube.com/watch?v=bziYKOL-U>

(n.d.). Retrieved from <http://www.boeing.com/space/starliner/launch/crew.html>

Northrop Grumman. (2021, July). Meet NG-16: The S.S. Ellison Onizuka. [Video]. Youtube.
<https://www.youtube.com/watch?v=D-0XkF9EOBw>

Pillownaut. (n.d). An Interview with NASA's Robyn Villavecchia. Rocket Scientist.
<http://www.pillownaut.com/webs/robyn.html>

Robert.wickramatunga. (n.d.). United Nations Office for Outer Space Affairs. Retrieved from
<https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html>

RSA Conference. (2020, March). Dr. Peggy Whitson: Breaking Record and Life at NASA | RSAC 2020. [Video] Youtube. <https://www.youtube.com/watch?v=jtLX6lcSvuw>

ShareAmerica. (2011, June). Former Astronaut Marsha Ivins on NASA's Global Partnerships. [Video] Youtube. <https://www.youtube.com/watch?v=3SrVhMNVrms>

Shatts, J. (2020, December). About Me. NASA Science Mars Exploration People Directory.
<https://mars.nasa.gov/people/profile/index.cfm?id=23147>

Smith, H. R. (2018, June). Who Was Sally Ride? NASA.
<https://www.nasa.gov/audience/forstudents/k-4/stories/nasa-knows/who-was-sally-ride-k4.html>

Space Center Houston. (2019, November). Astronaut Friday: Kalpana Chawla. Space Center Houston Blog. <https://spacecenter.org/astronaut-friday-kalpana-chawla/>



Space Center Houston. (2019, March). Astronaut Friday: Sunita “Suni” Williams. Astronaut Facts. <https://spacecenter.org/astronaut-friday-sunita-suni-williams/>

Space Facts (2022, April) Biographies of U.S. Astronauts. Space Facts.http://www.spacefacts.de/bios/astronauts/english/whitson_peggy.htm

Space Facts. (2021, November). Biographies of U.S. Astronauts. Space Facts. http://www.spacefacts.de/bios/astronauts/english/wilson_stephanie.htm

Space Facts. (2018, August). Biographies of U.S. Astronauts. Space Facts. http://www.spacefacts.de/bios/astronauts/english/ivins_marsha.htm

Space Facts. (2018, April). Biographies of International Astronauts. Space Facts. http://www.spacefacts.de/bios/international/english/tamayo-mendez_arnaldo.htm

Stein, V. (2019, April 11). Katie Bouman ‘hardly knew what a black hole was.’ Her algorithm helped us see one. PBS News Hour. <https://www.pbs.org/newshour/science/katie-bouman-hardly-knew-what-a-black-hole-was-her-algorithm-helped-us-see-one>

Stone, E. (2021, January). Sally Ride facts for kids: Biography and Accomplishments. <https://littleastronomy.com/sally-ride-facts-for-kids/>

The Strategerist. (n.d.). Retrieved from <https://www.bushcenter.org/publications/podcasts/channels/strategerist/index.html>

Sunita Williams Facts for Kids. Kiddle Encyclopedia.

TED. (2017, April 28). How to take a picture of a black hole | Katie Bouman.[Video] Youtube. <https://www.youtube.com/watch?v=BlvezCVcsYs>

TED-Ed. (March 5, 2020). NASA’s first software engineer: Margaret Hamilton - Matt Porter & Margaret Hamilton. [Video] Youtube. <https://www.youtube.com/watch?v=kYCZPXSVvOQ>

TeleSUR English. (2017, September). Arnaldo Tamayo Mendez- the First Person of African Heritage in Space. [Video]. Youtube. <https://www.youtube.com/watch?v=8mxcNXFe7dE>

TEDx Talks. (2012, September) My journey to space, Stephanie D. Wilson. [Video] Youtube. <https://www.youtube.com/watch?v=O8boaKsG0AQ&t=1s>



Watson, J. (2021, March 7). Margaret and the Moon read aloud. [Video] Youtube.
<https://www.youtube.com/watch?v=ywps6R6B4vY>

Weinstock, M. (2016, August). Margaret Hamilton Apollo Code. NASA Science.
<https://solarsystem.nasa.gov/people/320/margaret-hamilton/>

WowSTEM. (n.d.). *Mary Golda Ross: Fighter Flight*. A World of Women in STEM.
<https://www.wowstem.org/post/mary-golda-ross>