

Educating Space Age Environmentalists: A Pre-K-High School Standards-Based Curricular Approach

(Aligned to the 2016 Massachusetts Science and Technology/Engineering Standards for Earth and Space Science)

Pre-K



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www.protectouterspace.com

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Pre-K

Introduction:

Outer space is a valuable natural resource, serving as home to the International Space Station - where many different experiments are conducted that are beneficial to living beings on Earth. If spacecraft such as this are to continue operating, answers to the problem of space debris must be found.

Students gain an appreciation for the importance of spacecraft and outer space through learning about the moon as outlined in **PreK-ESS1-1 (MA)/ (Earth's Place in the Universe)**. In conjunction with this standard, students view two videos that help them understand why the moon is visible from Earth during the day, and why the moon changes shape throughout the month as it is viewed on Earth. Two books – one fiction and one nonfiction – pair well with studying this standard. The first NSTA-recommended book is entitled, *A Moon of My Own*, by Jennifer Rustgi. A nonfiction book entitled, *The Moon Seems to Change*, by Franklyn Branley, is one of the highly-regarded *Let's-Read-and-Find-Out Science* book series.

Extension 1 materials include two picture books (*Goodnight Spaceman*, by Michelle Robinson and *Mousetronaut*, by retired NASA astronaut Mark Kelly). Four NASA photographs of the moon taken from the International Space Station, as well as two moon photos taken from Earth, are helpful in showing preschoolers how views of the moon from space look different from how we see it on Earth – particularly in the level of detail seen from space. These resources help show students that space is not only beautiful and fascinating, but also that it is “home” to astronauts who are living and working in space to make life better for people on Earth.

Extension 2 features a space debris graphic for students to view and discuss. Students learn it's important to “pick up after oneself” in space, just as it is on Earth. They share their ideas regarding how “space junk” might be cleaned up. They then draw and color a picture of their design for space junk removal, and share it with their classmates, in alignment with **Pre-K-ESS3-2(MA)/(Earth and Human Activity)** and the Pre-K Speaking and Listening standards from the **2017 MA English Language Arts and Literacy Framework (Comprehension and Collaboration – 1, 2, 5, & 6)**. As a culminating activity, students cut out pictures of space debris objects and the International Space Station, and incorporate them into a space debris collage.

2016 Massachusetts Science and Technology/Engineering Curriculum Framework Alignment

Spacecraft Featured:
International Space Station

NASA Main Page for Featured Spacecraft:
[Click here](#) for International Space Station.

Disciplinary Core Idea/Sub-Idea:
ESS1. Earth's Place In the Universe
Earth and the Solar System (ESS1.B)

PreK: Earth and Space Sciences

ESS1. Earth's Place in the Universe

PreK-ESS1-1 (MA). Demonstrate awareness that the Moon can be seen in the daytime and at night, and of the different apparent shapes of the Moon over a month.

Clarification Statement:

- The names of moon phases or sequencing of moon phases is not expected.



Credit: NASA

This is a really big space station. We do a lot of various kinds of work here, different kinds of science experiments; we have over 400 different experiments going on at any one time in different areas, from basic science research to medical technology, that hopefully will benefit more people on Earth. –

–Astronaut Scott Kelly

Instructional Resources recommended by protectouterspace.com

Lesson: Moon Observations

Two brief SciShow Kids videos help preschoolers understand why the moon is visible from Earth during the day, and why the moon changes shape throughout the month as we view it here on Earth:

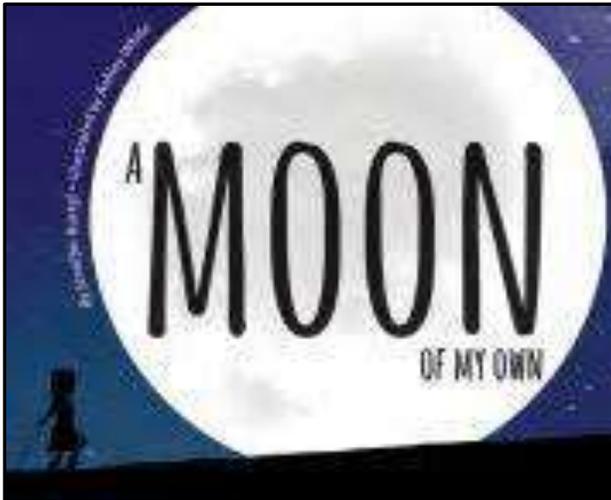
- **Video: *Why Can I See the Moon During the Day?* – SciShow Kids – (4 min.)**

This brief but informative video helps students understand why the moon is visible from Earth during the day. [Click here](#) for the video.

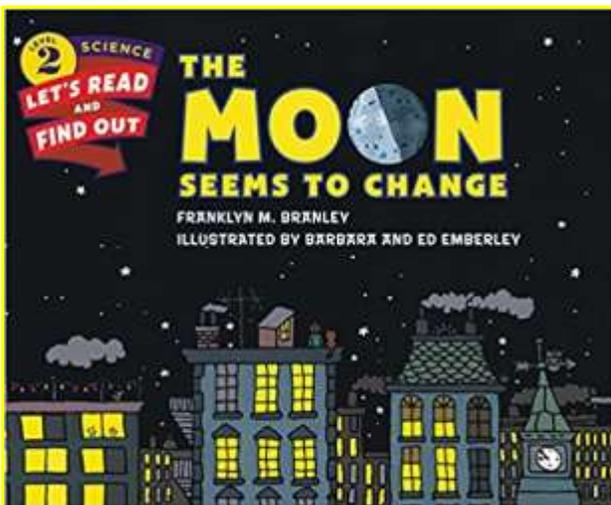
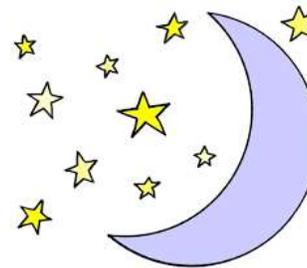
- **Video: *Why Does the Moon Change?* – SciShow Kids – (4 min.)**

This brief but informative video helps students understand why the moon changes shape throughout the month as we view it here on Earth. [Click here](#) for the video.

Two picture books – one nonfiction and one fiction – provide additional resources that align well with this lesson:



• **Book: Rustgi, Jennifer. *A Moon of My Own*.** Nevada City: Dawn Publications, 2016. Print. ISBN: 978-15846995738. (Age Range: 4-8 years/Grade Level: Preschool-3/Lexile Measure: 480) This book is recommended by NSTA for Pre-K – Grade 3 students. Quoting from the back of the book: *An imaginative young girl travels the world with her faithful companion, the moon. In her enchanted adventure she visits all seven continents while the moon goes through its cycle of phases as portrayed in silhouetted art. "Explore More" sections for kids and adults offer information and activities on phases of the moon and other aspects of astronomy and geography.*



• **Book: Branley, Franklyn M. and Barbara & Ed Emberley. *The Moon Seems to Change*.** New York: HarperCollins, 2015. Print. ISBN: 978-0062382061. (Let's-Read-and-Find Out Science 2 Series. Age Range: 4-8 years/Grade Level: Pre-K-3) This book belongs to the highly regarded *Let's-Read-and-Find-Out Science Books* series, designed to educate preschoolers and young elementary school students about basic science concepts. It is an excellent resource for teaching young children about the phases of the moon, and includes a simple experiment using an orange, a pencil, and a flashlight, designed to help students understand why the moon looks different at different times of the month. It also features content-specific vocabulary and simple diagrams.

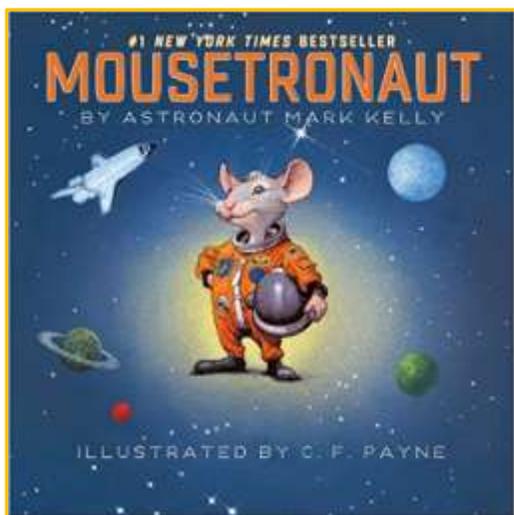


Clipart Credit: Clipartpanda.com

Extension 1: Outer space is a valuable natural resource, serving as home to spacecraft that provide essential information and perspective for understanding Earth’s Place in the Universe, Earth’s Systems, and Earth and Human Activity.

Instructional Focus: *The International Space Station provides astronauts with views of the moon that are similar to - but also different from how we see it from Earth, especially with respect to the level of detail.*

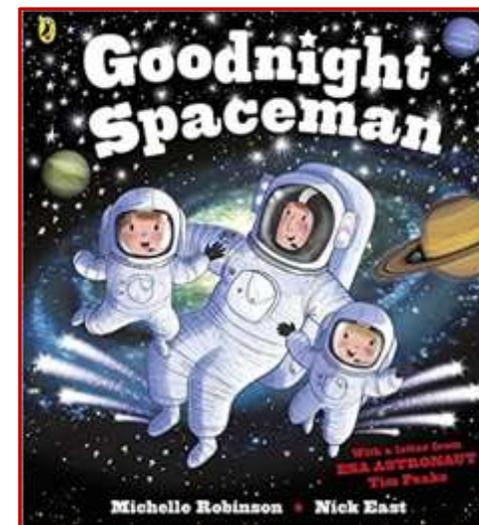
Extension 1 resources consist of two picture books, four NASA moon photographs from space, and two moon photographs taken from Earth – all helpful in teaching preschoolers that space is not only beautiful and fascinating in and of itself, but also that it is “home” to astronauts who are living and working up in space to make life better for living beings on Earth.



- **Book: Kelly, Mark and C.F. Payne. *Mousetronaut*.** New York: Paula Wiseman Books, 2012. Print. ISBN: 978-1442458246. (Age Range: 4-8 years/Grade Level: Preschool-3/Lexile Measure: 670L) This book, by bestselling author and retired NASA astronaut Commander Mark Kelly (recommended for grades Pre-K-3). Quoting from the back of the book: *A heartwarming picture book tale of the power of the small, from bestselling author and retired NASA astronaut Commander Mark Kelly. Astronaut Mark Kelly flew with “mice-tronauts” on his first spaceflight aboard space shuttle Endeavour in 2001. Mousetronaut tells the story of a small mouse that wants nothing more than to travel to outer space. The little mouse works as hard as the bigger mice to show readiness for the mission . . . and is chosen for the flight! While in space, the astronauts are busy with their mission when disaster strikes—and only the smallest member of the crew can save the day. With lively illustrations by award-winning artist C. F. Payne, Mousetronaut is a charming tale of perseverance, courage, and the importance of the small!* This book is due to be read shortly from the International Space Station. **Once the video is posted, students will be able to listen to an astronaut reading the book aloud from space.** [Click here](#) for the *Story Time from Space* website.

[Click here](#) for a brief (4 min.) video that provides additional background on *Story Time from Space*.

- **Book: Robinson, Michelle and Nick East (with an introduction by NASA Astronaut Cady Coleman). *Goodnight Spaceman*.** Hauppauge: Barron’s Educational Series, Inc., 2016. Print. ISBN: 978-1-4380-1086-1. (Age Range: 2-5 years) This book provides an excellent way to introduce preschoolers to the value of outer space, as home to astronauts who are conducting experiments and learning something new every day to make life better for all of us here on Earth. The book opens with a greeting to students from Colonel Cady Coleman, a former NASA astronaut and retired U.S. Air Force officer, who spent almost six months living aboard the International Space Station as a crew member. In this greeting, addressed to “fellow space travelers,” Colonel Coleman describes herself as an “Astronaut Mom” who recalls how much she enjoyed reading bedtime stories to her son Jamey from space. She encourages students to see themselves as future engineers, explorers, and captains of their own spaceships some day!



- **Four NASA photographs** – two of the moon taken from the International Space Station, and two moon photos taken from Earth - help students see that pictures of the moon taken from space look similar to pictures of the Moon taken from Earth, but the pictures taken from space provide much more detail.



"Moon Rise from the Space Station"

-(Left) [Click here](#) for "Moon Rise from the Space Station" – NASA astronaut Randy Bresnik took this picture of the moon rising from his vantage point in low Earth orbit aboard the International Space Station on August 3, 2017. He wrote, "Gorgeous moon rise! Such great detail when seen from space."

-(Right) [Click here](#) for "Space Station View of the Full Moon" – NASA Expedition 48 Commander Jeff Williams took this picture from the International Space Station on June 21, 2016, writing, "A spectacular rise of the full moon just before sunset while flying over western China."



"Space Station View of the Full Moon"



"Goodnight, Moon"

-(Left) [Click here](#) for "Discovery Aglow" (Slide 20)
A nearly full moon sets as the space shuttle Discovery sits atop Launch pad 39A at the Kennedy Space Center in Cape Canaveral, Florida, in the early morning hours of March 11, 2009.



"Full Moon Over Endeavor"
Photo Credits: NASA

-(Right) [Click here](#) for "Full Moon Over Endeavor" – Above Launch Pad 39A at NASA's Kennedy Space Center in Florida, the full moon hovers over space shuttle Endeavour waiting for liftoff on the STS-126 mission.

Extension 2: The growing problem of space debris requires us to clean up the space environment – utilizing new technologies and public advocacy – before it becomes too dangerous to navigate.

Instructional Focus: Students learn it's important to "pick up after oneself" in space, just as it is on Earth, as they color and cut out pictures of space debris objects and the International Space Station and incorporate them in a space debris collage.

Standards Alignment

2016 MA Science and Technology/Engineering Curriculum Framework:

ESS3. Earth and Human Activity

PreK-ESS3-2(MA). Observe and discuss the impact of people's activities on the local environment.

2017 MA English Language Arts and Literacy Framework:

Pre-K Speaking and Listening Standards [SL]

Comprehension and Collaboration

1. Participate in collaborative conversations with diverse partners during daily routines and play.

2. Recall information for short periods of time and retell, act out, or represent information from a text read aloud, a recording, or a video (e.g., watch a video about birds and their habitats and make drawings or constructions of birds and their nests).

Presentation of Knowledge and Ideas

5. Create representations of experiences or stories (e.g., drawings, constructions with blocks or other materials, clay models) and explain them to others.

6. Speak audibly and express thoughts, feelings, and ideas.

Extension 2 resources features a space debris graphic and a drawing/sharing activity of a space junk solution. As a culminating activity, students create and share their own space debris collage.



1. NASA Space Debris Graphic

Following a discussion about the Moon's place in the universe, its phases, and its position in relation to Earth, show students this NASA space debris graphic. Explain that the little dots/objects represent pieces of space debris that are orbiting continuously around the Earth, and no longer serve a useful purpose; rather, this debris (or "junk") is endangering astronauts and spacecraft due to the risk of collisions. Explain the source of this debris, and provide specific examples, such as: discarded rocket parts, obsolete satellites that no longer work, leftover fuel tanks, old rocket boosters, bolts and screws, paint flecks, and items astronauts have lost in space – such as tools and gloves.

Emphasize that this space junk must be cleaned up to keep astronauts and spacecraft safe. Compare this to the importance of keeping our environment clean here on Earth. Remind students that they do this at home by keeping their rooms neat, cleaning up after themselves, picking up their toys, and disposing of their trash correctly. Stress with students the importance of also doing this in space. Keeping outer space clean is very important so that astronauts can continue to work safely there, and spacecraft can continue to operate – providing us with important information to keep all living beings healthy and safe. Emphasize with students that space junk can destroy a spacecraft, and that even a paint fleck – traveling at a high rate of

speed – can cause damage, as it did to a window in the International Space Station. As students have been studying the moon and have gained an appreciation for its mystery and beauty, emphasize that without spacecraft, we would not have the detailed pictures of the moon that we now have. Tell the students that if we hope to travel to the moon again in the future, outer space clean must be clean so spacecraft can get there safely. [Click here](#) for the graphic. (Additional NASA space debris graphics are found by [clicking here](#).)

2. “Space Junk” Cleanup Solutions

Discuss with students what they think a “space junk” cleanup vehicle might look like. Have students draw and color a picture, and share it with their classmates. Emphasize with students that scientists and engineers are currently considering many different concepts for space junk cleanup, and that perhaps in the future, they may want to become aerospace engineers and design space debris solutions to help solve this problem.

3. Culminating Activity – Space Debris Collage

As a fun culminating activity, have each student make his/her own space debris collage, using such materials as: black paper or poster board, glue, crayons, and a collection of small items – such as bottle caps, jar lids, buttons, dried beans, pieces of Styrofoam cups or trays, aluminum foil, nuts and bolts, small screws, straws, pipe cleaners, orange juice caps, milk bottle caps, toilet paper rolls, and paper cups – to represent space debris.

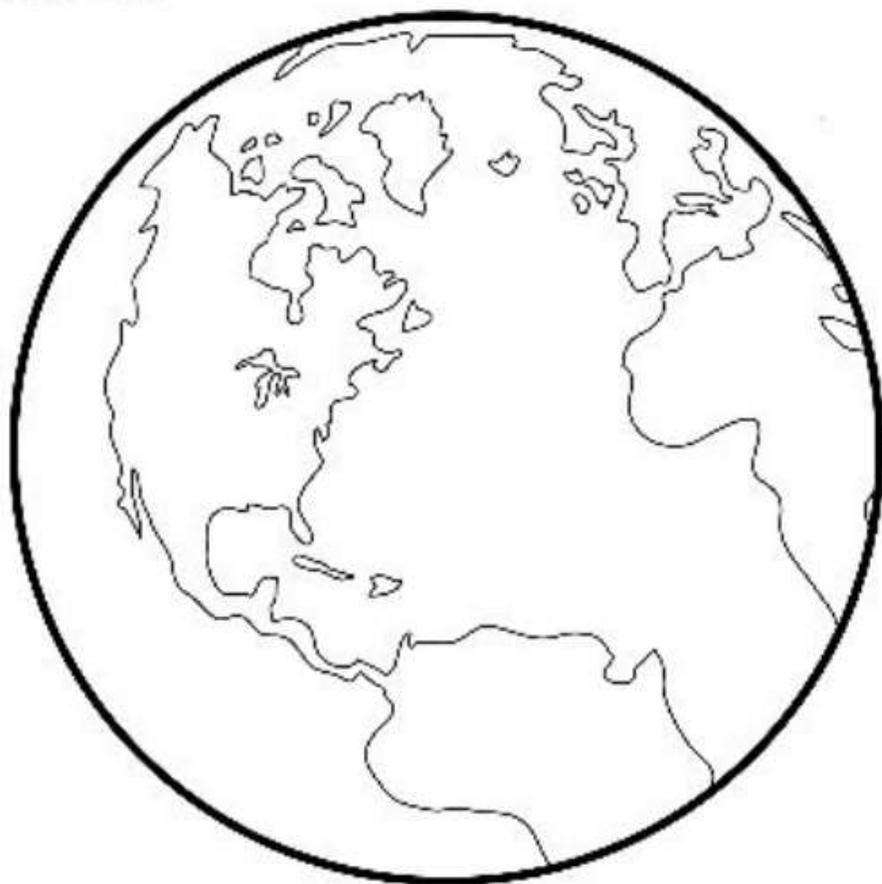
Directions:

1. Distribute the Earth coloring page (attached). Instruct students to color and cut out the Earth shape.
2. Give each student a piece of black paper or poster board, and have him/her paste the Earth shape onto the center of the board.
3. Distribute the space debris cutout page (attached), and – if desired – the cutout pages containing the astronaut, the moon, the rocket, and the International Space Station (attached). Have students pick several space debris shapes to color and cut out to paste into their collage, as well as any of the other shapes they wish to add.
4. Distribute the other small items described above (i.e., bottle caps, buttons, dried beans, nuts and bolts, etc.), and have students paste this “space debris” onto their collage, so that it forms a circle “orbiting” the Earth.
5. The students may add their space junk cleanup vehicle to their collage, if desired, as well as any other finishing touches, such as gold or silver stars, the sun, planets, etc.
6. Encourage the students to share their creations by showing and describing them to their classmates.



Space Cutouts

Earth

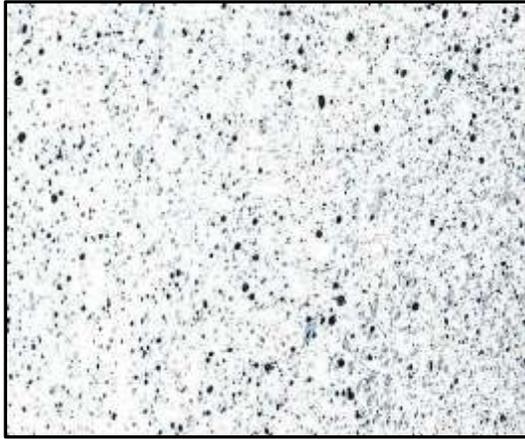


Moon

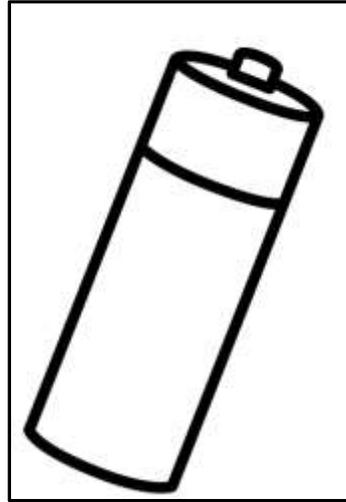


Space Debris Cutout Page

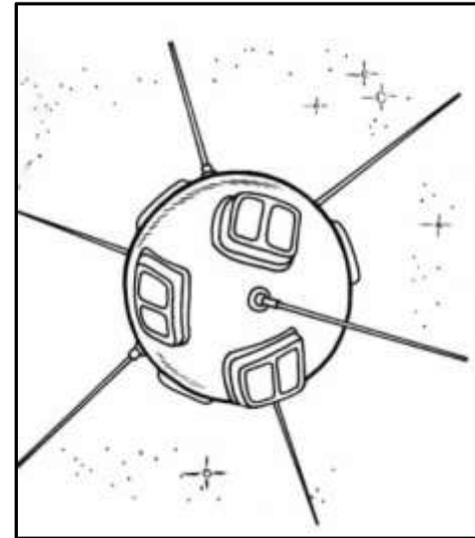
Paint Flecks



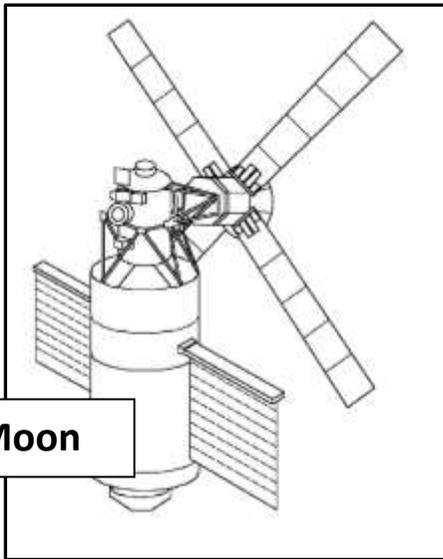
Old Battery



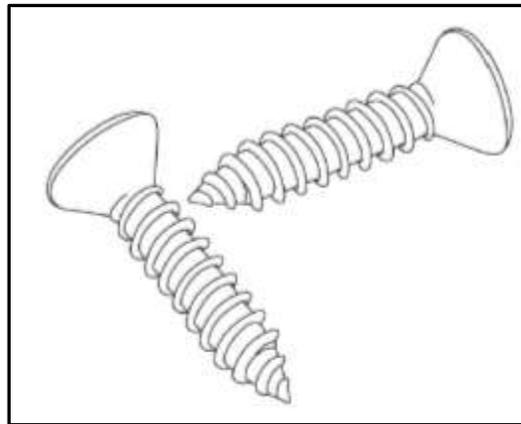
Explorer 1 Satellite - 1958



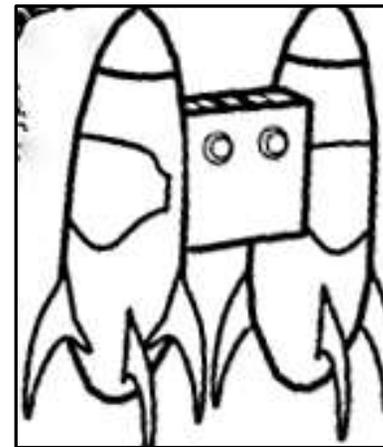
Old Satellite



Screws



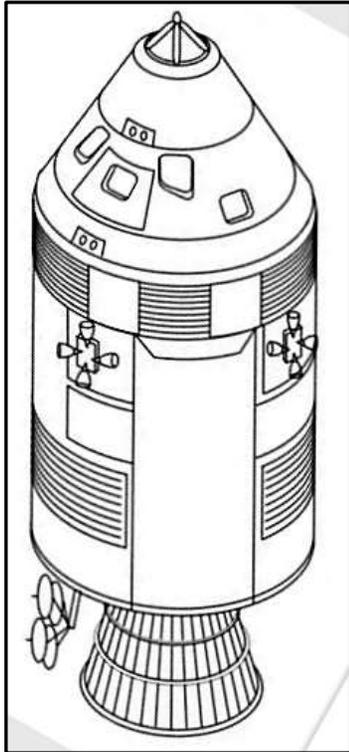
Leftover Fuel Tanks



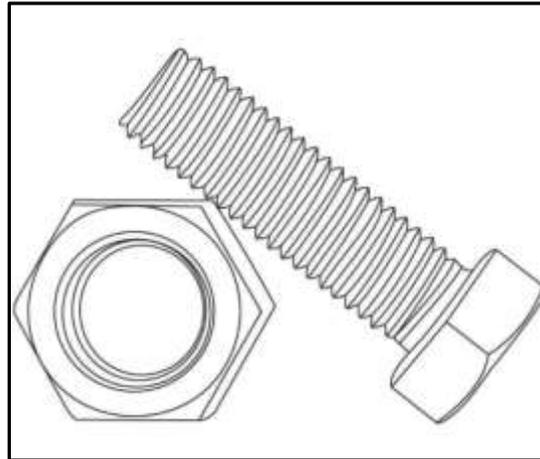
Moon

Space Debris Cutout Page

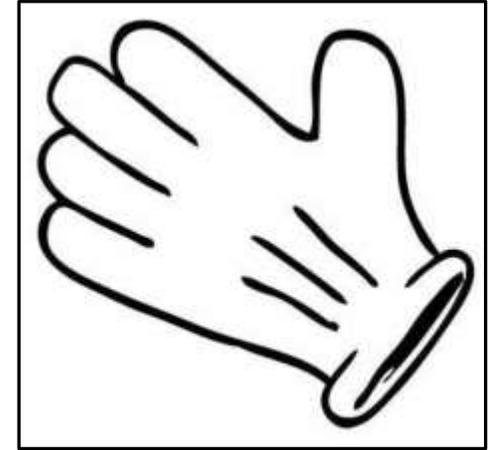
Discarded Rocket



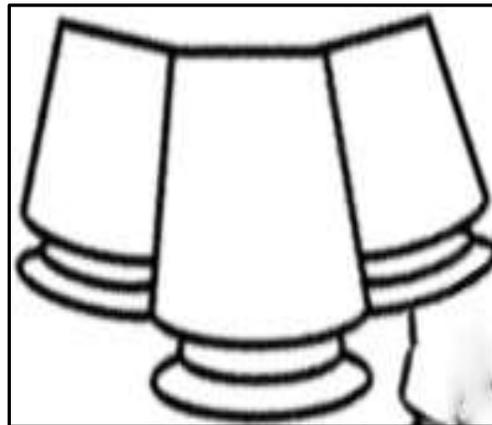
Nuts and Bolts



Glove

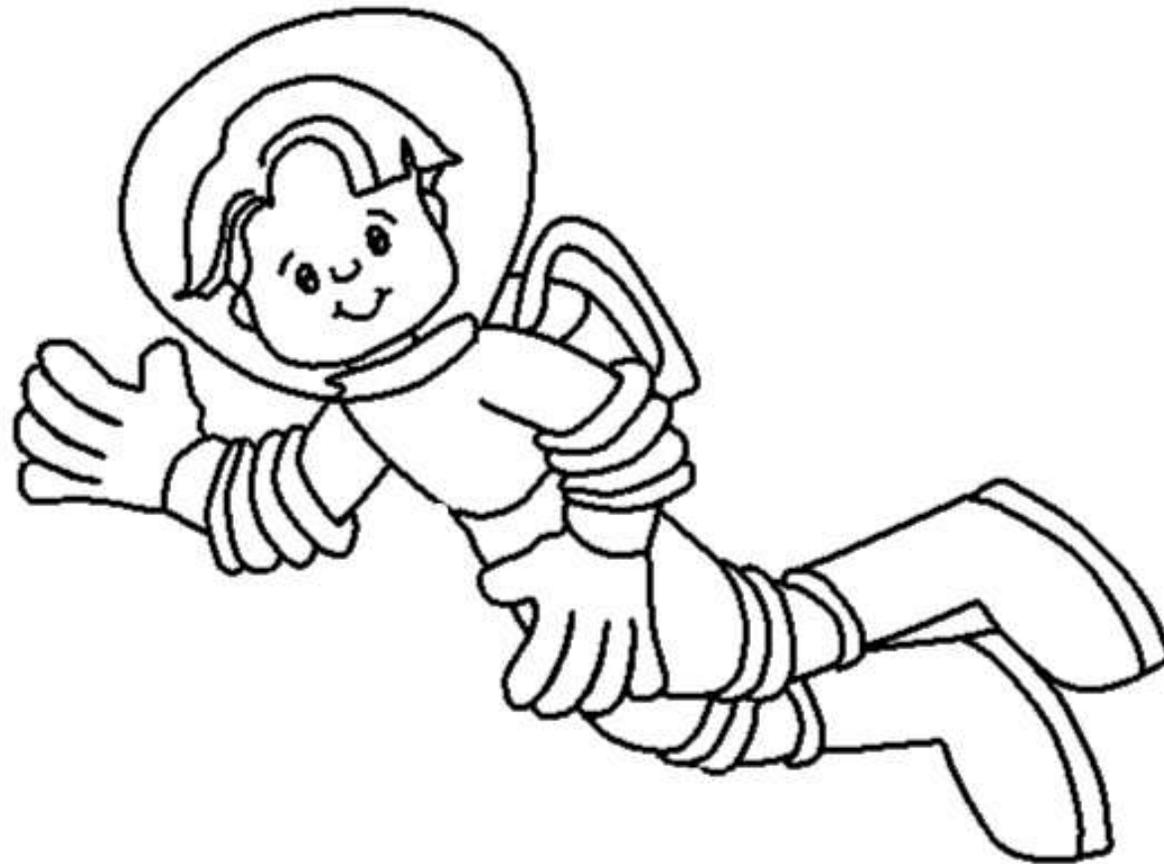


Old Rocket Booster



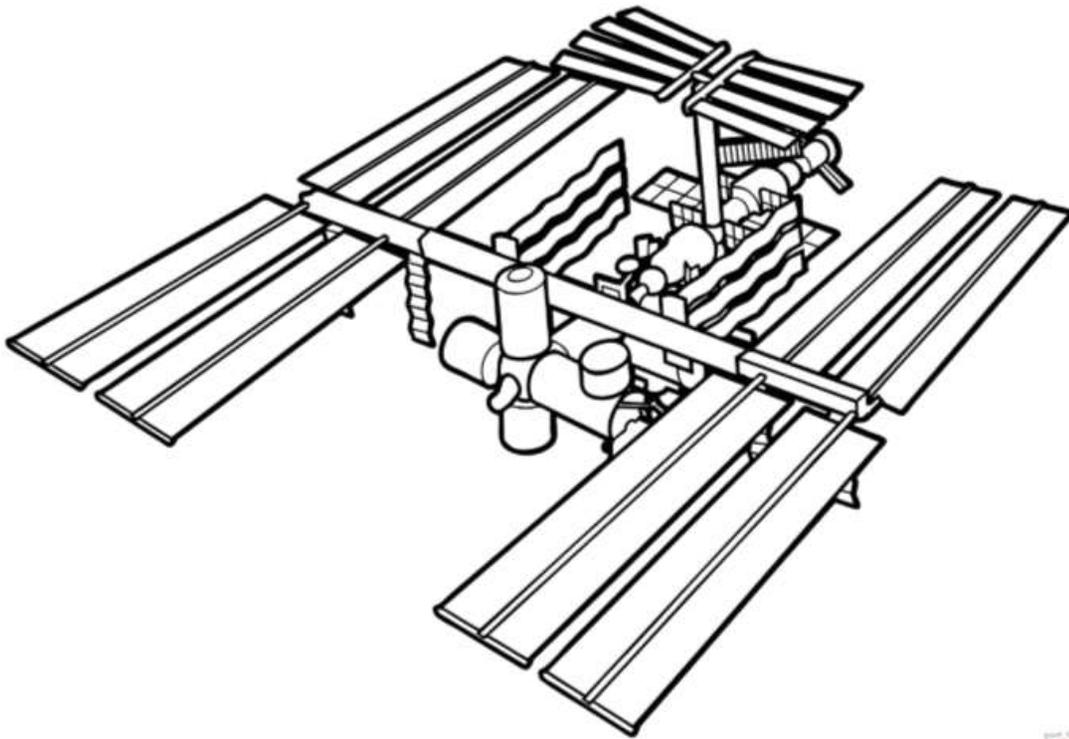
Space Cutouts

Astronaut



Space Cutouts

International Space Station



Rocket

