

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)

Kindergarten



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Introduction:

Outer space is a valuable natural resource, serving as home to the GOES-R weather satellites, essential to monitoring Earth's weather from space. The problem of space debris must be addressed so that these satellites can continue to operate.

Students gain an appreciation of the importance of weather satellites through participating in a lesson entitled, "Severe Weather – Blizzards – Let It Snow!" aligned with **K-ESS2-1 (Earth's Systems)** and **K-ESS3-2 (Earth and Human Activity)**. A picture book entitled *Whiteout*, by Rick Thomas, pairs well with this lesson. Through viewing images taken from space and observing crystals, students learn about blizzards. Alternatively, another NSTA-vetted lesson focusing on hurricanes – "Severe Weather – Hurricanes – Tropical Storms Run Amok!" also aligns well with this standard. Students learn why hurricanes are so dangerous. Through reading and discussing a book entitled, *Eye of the Storm – A Book About Hurricanes (Amazing Science: Weather)*, by Rick Thomas, viewing images of hurricanes taken from space, and building a model, students are able to explain the structure of a hurricane.

The Extension 1 resource is a video entitled, "Meet GOES-R," which helps young students understand how a satellite works.

Extension 2 features a space debris graphic for students to view and discuss. Students learn it's important to clean up "space junk" so that satellites can continue to operate safely. They discuss their ideas for how "space junk" might be cleaned up, draw and color a picture of their design, and share it with their classmates, in alignment with the Kindergarten Speaking and Listening standards from the *2017 MA English Language Arts and Literacy Framework*. (Comprehension and Collaboration – 1.a.) As a culminating activity, students create and share their own orbital space debris tabletop display.

2016 Massachusetts Science and Technology/Engineering Curriculum Framework Alignment	Spacecraft Featured: <i>GOES Weather Satellites</i>	NASA Main Page for Featured Spacecraft: Click here for GOES-R.
<p>Disciplinary Core Idea/Sub-Idea: ESS2. Earth's Systems Weather and Climate (ESS2.D) and ESS3. Earth and Human Activity Natural Hazards (ESS3.B)</p> <p>Kindergarten: Earth and Space Sciences</p> <p>ESS2. Earth's Systems</p> <p>K-ESS2-1. Use and share quantitative observations of local weather conditions to describe patterns over time.</p> <p style="text-align: center;">-and-</p> <p>ESS3. Earth and Human Activity</p> <p>K-ESS3-2. Obtain and use information about weather forecasting to prepare for, and respond to, different types of local weather.</p>	 <p>Credit: NASA</p>	<p><i>The Geostationary Operational Environmental Satellites...provide continuous imagery and atmospheric measurements of Earth's Western Hemisphere, total lightning data, and space weather monitoring to provide critical atmospheric, hydrologic, oceanic, climatic, solar and space data.</i></p> <p style="text-align: right;">-NASA/NOAA Press Release Nov. 19, 2016</p>
NSTA-Vetted Lesson Plans – NGSS@NSTA		
<p>Lesson: "Severe Weather – Blizzards – Let It Snow!" Big idea: Why is it important to know about snowflakes?</p> <ul style="list-style-type: none"> This lesson is #5 in a unit about severe weather. Using the book entitled, <i>Whiteout</i>, by Rick Thomas (Recommended by NSTA – ages 4-9 years), images taken from space, and observing crystals, students will learn about blizzards. Click here for a description of the lesson, a full listing of alignment to NGSS, and suggested modifications to more fully align with the NGSS. Click here for the lesson plan, the materials needed, and a listing of where to access accompanying resources. <p>Alternatively, another NSTA-vetted lesson focusing on hurricanes also aligns well with this standard.</p> <p>Lesson: "Severe Weather – Hurricanes – Tropical Storms Run Amok!" Big idea: Why are hurricanes so dangerous?</p>		

- This is #4 in a unit about severe weather. Using the book, *Eye of the Storm – A Book About Hurricanes (Amazing Science: Weather)*, by Rick Thomas, images of hurricanes taken from space, and building a model, students will be able to explain the structure of a hurricane.

[Click here](#) for the lesson plan, the materials needed, and a listing of where to access accompanying resources are found.

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.

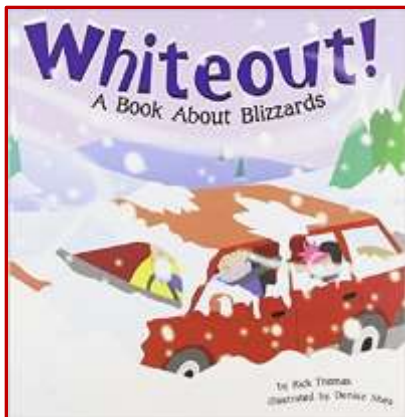
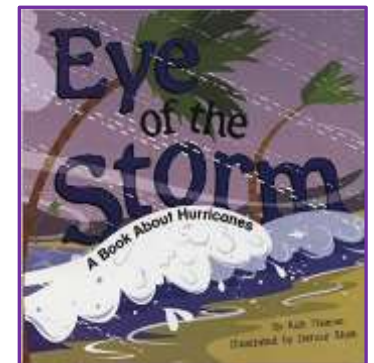
Instructional Focus: *The Geostationary Operational Environmental Satellite-R Series (GOES-R) provides critical information for weather forecasting, including severe storm watches and warnings that help communities prepare for blizzards and hurricanes.*

Three nonfiction books selected and recommended by *protectouterspace.com* are excellent resources to use in conjunction with these lessons.



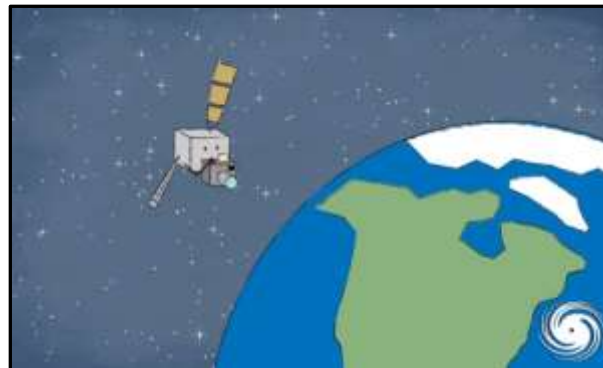
- **Book: Stewart, Melissa and Taia Morley. *Hurricane Watch*.** New York: HarperCollins, 2015. Print. ISBN: 978-0062327758. (Let's-Read-and-Find-Out Science 2 Series. Recommended by the *School Library Journal* for grades 1-3. Age Range: 4-8 years/Grade Level: Preschool – 3). Part of the *Let's-Read-and-Find-Out Science 2* series, this book was named an Outstanding Science Trade Book by the NSTA. It contains fascinating facts about hurricanes, as well as engaging visuals and diagrams showing how hurricanes form, how scientists track storms, and what people can do to keep themselves safe in a hurricane. In the "Find Out More" section, an activity on air pressure is also included, along with a glossary of storm and weather vocabulary.

- **Book: Thomas, Rick and Denise Shea. *Eye of the Storm: A Book About Hurricanes*.** North Mankato: Picture Window Books, 2005. Print. ISBN: 978-1-4048-1845-3. (Amazing Science Series; Recommended by *National Science Teachers Association*/Age Range: 4-9 years/Grade Level: K-3/Lexile Measure: 640L.) From the Amazon.com website: *Describes the process of how hurricanes can form. Also includes explanations of tropical storms and a storm surge.*



- **Book: Thomas, Rick and Denise Shea. *Whiteout: A Book About Blizzards*.** North Mankato: Picture Window Books, 2005. Print. ISBN: 978-1-4048-1850-7. (Amazing Science Series; Recommended by *National Science Teachers Association*/Age Range: 4-9 years/Grade Level: K-3/Lexile Measure: 630L.) From the Amazon.com website: *Describes what one would experience in a blizzard, including whiteouts, strong winds, snowdrifts, and wind chills.*

- **Video: Meet GOES-R** – This video is a helpful tool to use in explaining to young students how a satellite works. It is easily integrated into the lesson after students view a satellite image of a blizzard or a hurricane. At that point, the teacher may wish to show students a picture of a blizzard or a hurricane taken on Earth, and then ask them to identify the differences between the two. After further discussion, a viewing of the *Meet GOES-R* video helps students understand that the GOES-R weather satellites, orbiting 22,000 miles above the planet, provide valuable information to help people on Earth stay safe in all types of weather. [Click here](#) for the video. (From video – “Meet GOES-R” – NOAA/NASA – Dec. 9, 2015)



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 that “space junk” is orbiting the Earth and putting satellites at risk. They discuss their ideas for how “space junk” might be cleaned up, draw and color a picture of their design, and make an orbital space debris tabletop display, showing and describing their work to their classmates, in alignment with the Speaking and Listening standards from the 2017 MA English Language Arts and Literacy Framework.

Standards Alignment – 2017 MA English Language Arts and Literacy Framework:

Kindergarten Speaking and Listening Standards [SL]

Comprehension and Collaboration

1. Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.
 - a. Follow agreed-upon rules for discussions (e.g., listening to others and taking turns speaking about the topics and texts under discussion).

Extension 2 resources feature a space debris graphic and a drawing activity of a space junk solution. As a culminating activity, students create and share their own orbital space debris tabletop display with their classmates.



1. NASA Space Debris Graphic

Following a discussion about the key role that GPS satellites play in tracking bird migration, show students a 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 out 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 about the importance of accurate weather forecasting in preparing for severe weather, emphasize that without spacecraft, we would not be able to obtain the accurate weather forecasts and climate information that we need to stay safe. [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 ideas 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 – Orbital Space Debris Tabletop Display

As a fun culminating activity, have students make their own orbital space debris tabletop display. Materials needed for this activity: Paper plate, paper bowl, brass fastener, sharp pencil or nail, crayons, scissors, hole punch, paper, and poster board or thin cardboard. (This activity is adapted from the Orbiting Object Paper Plate Craft, contributed by Leanne Guenther, found at <http://www.dltk-kids.com/crafts/space/morbit.htm>.)

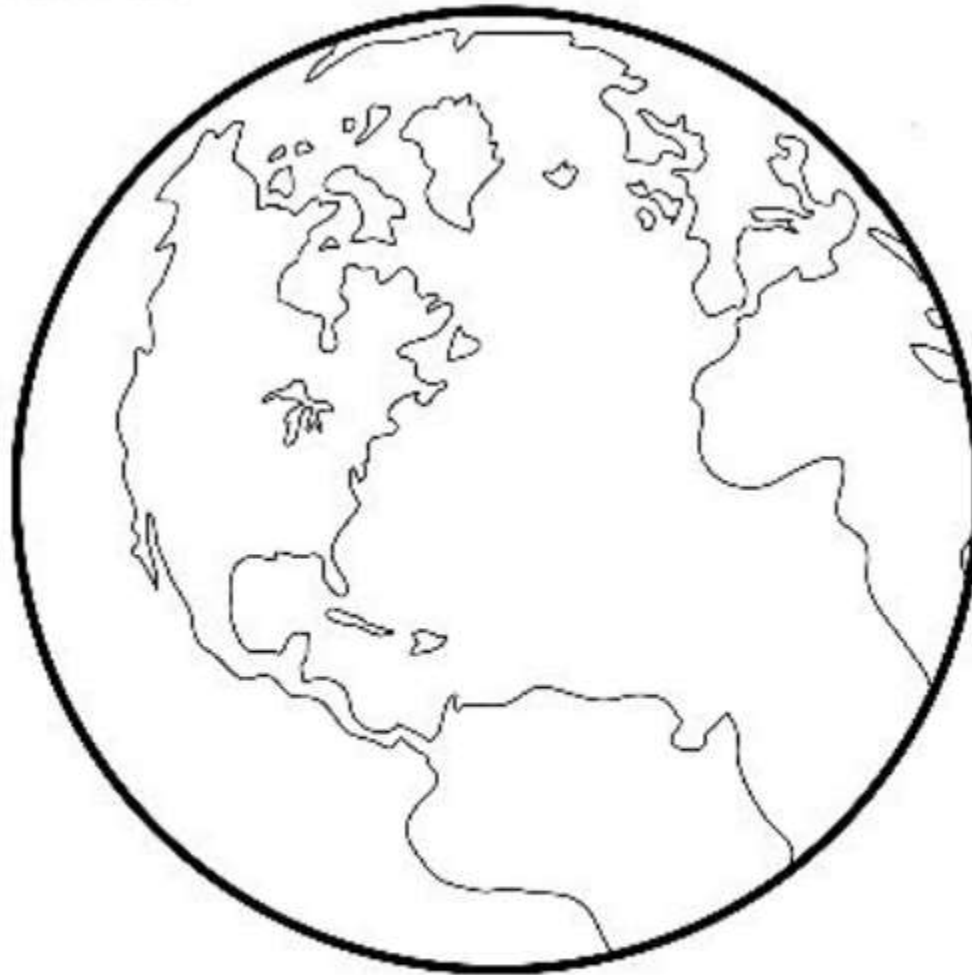
Directions:

1. Distribute the Earth coloring page (attached). Instruct students to color and cut out the Earth shape.
2. Give each student a paper plate. Have him/her glue the Earth shape to the paper plate.

3. Place the plate on top of a paper bowl (to use for a stand), with the open side of the bowl facing down.
4. With adult assistance, poke a hole in the center of the plate and the center of the bowl with a sharp pencil or nail. Set the bowl aside.
5. Distribute the space debris cutout page (attached). Have students pick seven of the space debris shapes to color and cut out (in addition to their own cleanup invention that they would have already drawn and cut out).
6. Distribute the picture of the GOES-R satellite (attached). Have students color and cut it out to add to their display.
7. Have the students trace the template for the tabs and pictures onto poster board or thin cardboard, and then cut them out. (The cardboard base will help make the tabs and pictures a little sturdier.)
8. Have the students glue the 8 tabs and pictures onto the cardboard base.
9. Use the hole punch to punch a hole in the bottom of each of the eight tabs.
10. Assemble the display by pushing the brass fastener through the paper plate, the base containing the eight tabs with pictures, and the inverted bowl.
11. Once the craft is complete, the students will be able to rotate the space junk, the GOES-R satellite, and their space debris cleanup solution in orbit around the Earth.
12. Encourage the students to share their creations by showing and describing them to their classmates.



Earth Coloring Page



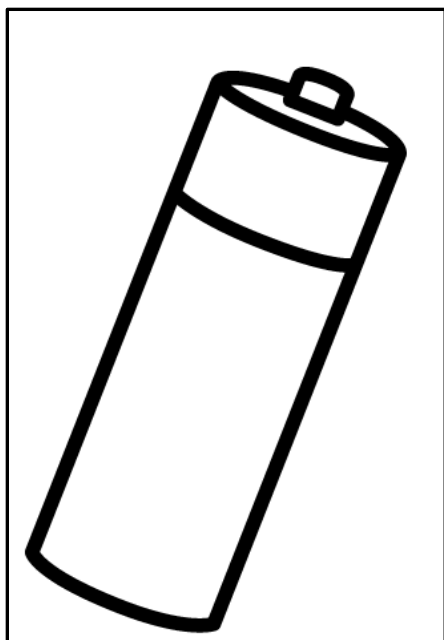
Earth

Space Debris Cutout Page

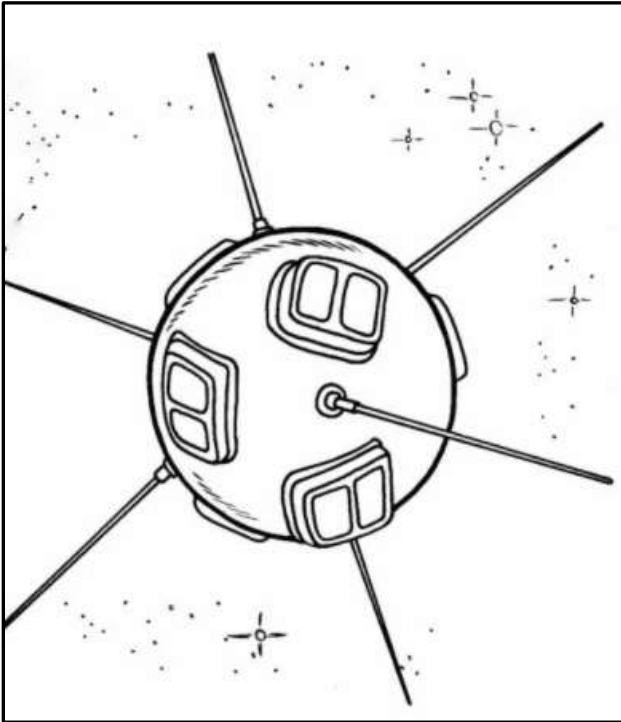
Paint Flecks



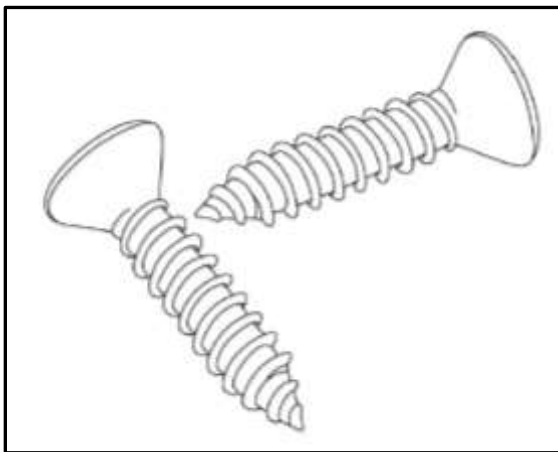
Old Battery



Space Debris Cutout Page



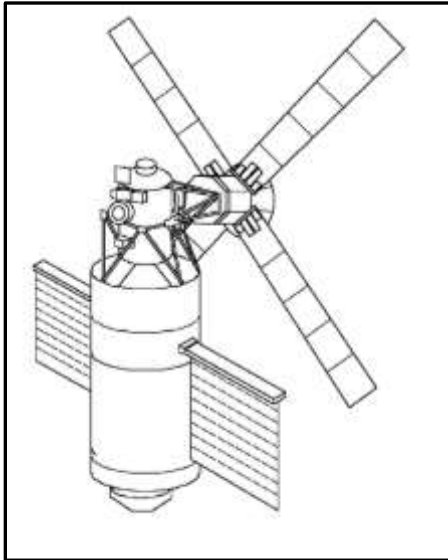
Explorer 1 Satellite - 1958



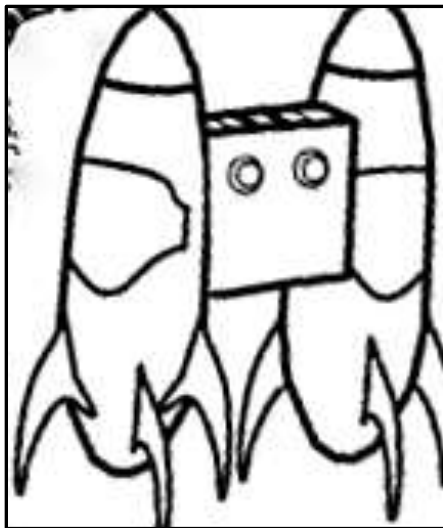
Screws



Space Debris Cutout Page

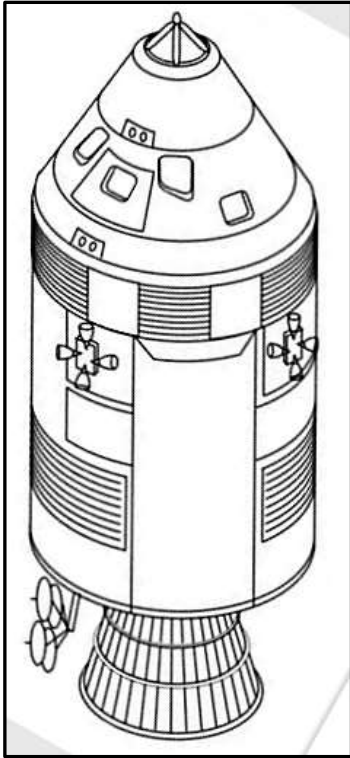


Old Satellite

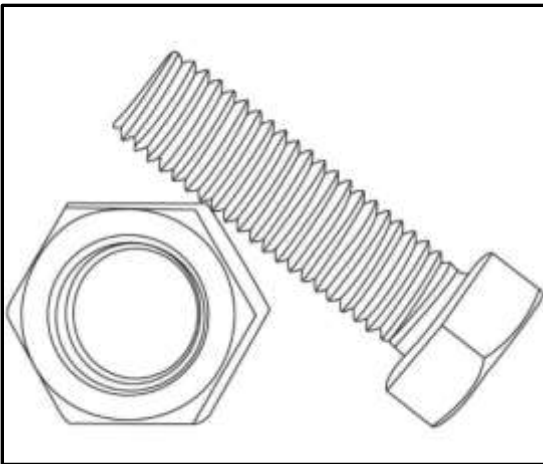


Leftover Fuel Tanks

Space Debris Cutout Page



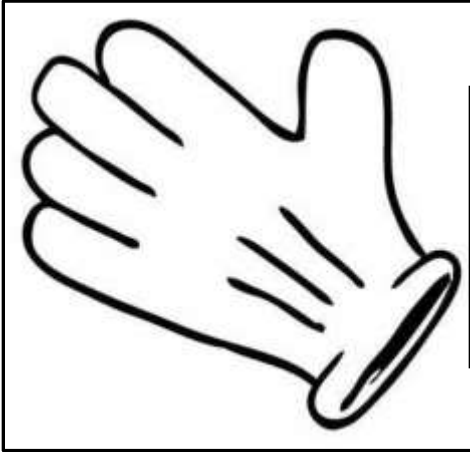
Discarded Rocket



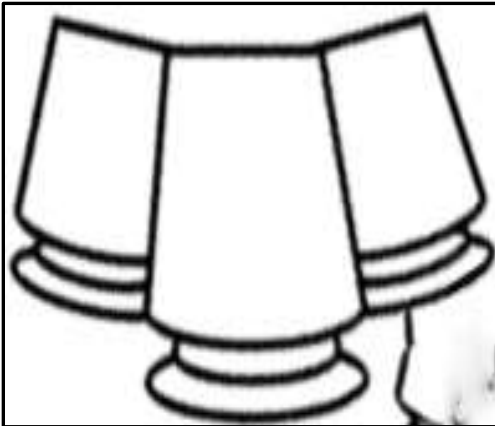
Nuts and Bolts



Space Debris Cutout Page

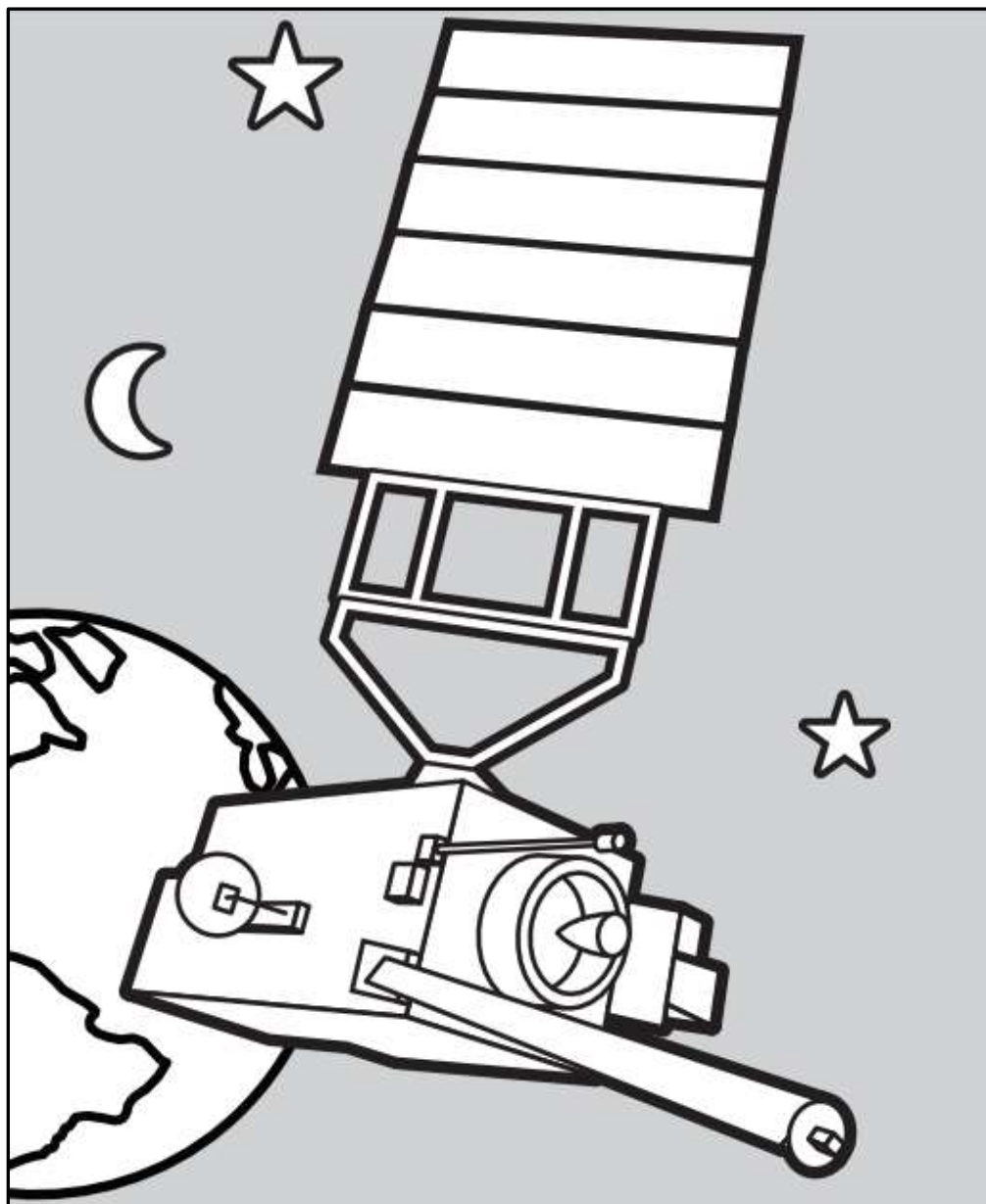


Glove



Old Rocket Booster





GOES-R Satellite Coloring Page (from *GOES-R Fun Activity Book* – NASA)