

# **Earth from the ISS: Using the Crew Earth Observations (CEO) Mission to Explore Earth**

## **Grade 6**

**Duration:** 7-9 45 minute periods

**Materials:** Computer and projector; internet; 1:1 devices to access websites **or** print copies of articles (links provided); handouts (provided); science journals/binders (notebooks)

**Prior Knowledge:** Students will have an understanding of the history and purpose of the International Space Station. They will have investigated some of the projects/research being conducted.

In this lesson, students will discover the CEO mission and its benefits. They will investigate the history of the CEO mission, the scientific purposes, and the benefit of the project for astronauts aboard the ISS. Students will also evaluate some of the photos for aesthetics in order to understand the value of the project for astronauts and the value of art in a scientific environment.

### **Lesson Essential Questions:**

What is the ISS CEO mission?

Why would the work being done through CEO benefit scientists on Earth?

What are the challenges the astronauts face when working to capture specific data through images?

What is the benefit of participation in the CEO mission to astronauts aboard the ISS?

### **Standards:**

**Grade 6 Science** \*This lesson does not perfectly align with the NGSS standards, however, it serves to build foundational knowledge that will lead into the following NGSS standard:

**NGSS: MS-ESS1-3** Analyze and interpret data to determine scale properties of objects in the solar system.

**Clarification Statement:** Emphasis is on the analysis of data from Earth-based instruments, space-based telescopes, and spacecraft to determine similarities and differences among solar system objects. Examples of scale properties include the sizes of an object's layers (such as crust and atmosphere), surface features (such as volcanoes), and orbital radius. Examples of data include statistical information, drawings and photographs, and models.

<p><b>Science &amp; Engineering Practices:</b>  <b>Analyze and interpret data to determine similarities and differences in findings</b></p>	<p><b>Disciplinary Core Ideas:</b>  <b>Earth in the Solar System</b>  The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.</p>	<p><b>Crosscutting Concepts:</b>  <b>Scale, Proportion, and Quantity</b>  Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.</p> <p>Interdependence of Science, Engineering, and Technology  Engineering advances have led to important discoveries in virtually every field of science and scientific discoveries have led to the development of entire industries and engineered systems.</p>
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**Pennsylvania Core ELA Standards:**

**CC.1.2.6.B**

Cite textual evidence to support analysis of what the text says explicitly, as well as inferences and/or generalizations drawn from the text.

**CC.1.2.6.F**

Determine the meaning of words and phrases as they are used in grade-level reading and content, including interpretation of figurative language in context.

**CC.1.2.6.J**

Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.

**CC.1.4.6.C**

Develop and analyze the topic with relevant facts, definitions, concrete details, quotations, or other information and examples; include graphics and multimedia when useful to aiding comprehension.

**CC.1.5.6.D**

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.

**Procedure:**

**Periods 1-2**

**Engage:** Pose the following questions: You probably don't remember seeing the sunrise or sunset for the first time, but do any of you remember seeing a sunrise or sunset from a particular location for the first time (perhaps the beach, from a vantage point other than where you live,

etc.)? What was the experience like? (After wait time and if needed, I would share the stories of seeing the sunrise from the beach (Atlantic) and from Cadillac mountain—highest point on the east coast.)

Next, introduce the concept of capturing images of Earth from space by showing and discussing the [Moon Rise](#) video.

### **Explore:**

Reference the lesson EQs (which should be posted for students to see):

*What is the ISS CEO mission?*

*Why would the work being done through CEO benefit scientists on Earth?*

*What are the challenges the astronauts face when working to capture specific data through images?*

*What is the benefit of participation in the CEO mission to astronauts aboard the ISS?*

Begin by asking students to take out their science journals (we use binders with handouts and loose leaf), distributing the handout (Crew Earth Observation Webpage Guide), and projecting the [NASA webpage](#) that provides an overview of the ISS CEO mission. Show students the headings and how they line up with the handout for their binders. Read at least the first section whole class and answer the guided reading questions together.

### **Explain:**

Next, students will read and work through the guided questions and vocabulary independently. Invite students to add words to the vocabulary column as needed. (Formative Assessment) We use Chromebooks and I use Google Classroom. For easy access to the webpage, I'd create a Google Doc with the link, however, the URL can be written on the board or added to the handout.

When students complete the guided reading work, share the [image database](#) and give students time to explore, while their work is checked. If time permits, allow students to share some images they found intriguing.

### **Elaborate/Extend:**

The guided reading of the webpage can be differentiated for differently-abled learners. Vocabulary can be added or removed. Students may be grouped. The teacher may work through multiple sections with group(s) or individuals who require more scaffolding. Students who read

and comprehend at a faster pace may be directed to the “Results Publications” section near the bottom of the page and invited to further investigate an area of interest.

### **Period 3**

Return and review the guided reading handout.

Project the [Psychology Today article](#) and read whole class. Break periodically for students to take brief notes of summary in their journals/binders.

Distribute Exit Ticket. (Formative Assessment)

### **Periods 4-6**

Ask volunteers to share their Exit Ticket responses.

#### **Evaluate:**

Distribute the CEO Scenario handout. Students will work in groups of 4-5 to write a script in which they will role-play talk show hosts and astronauts. Students will use the webpage, Psychology Today article, and their journals/binders as resources to create interview questions and answers. Questions and answers should be approved before students begin rehearsing. The teacher should spend time questioning each group to ensure participation and address issues. (Formative Assessment)

#### **Elaborate/Extend:**

This assessment can be differentiated to accommodate the needs of differently-abled learners. I group students randomly to simulate a work-place environment, however, students can be grouped according to needs. Sample questions can be provided to support students. The teacher can aid in the location of the information students need to compose their answers. The criteria I've selected can be adapted and this [presentation rubric](#) could be used in place of the criteria upon which I've chosen to focus. Students who required additional challenge can be encouraged to add greater detail to their scripts by exploring some of the links at the bottom of the webpage.

### **Periods 7-9 (depending on the number of groups)**

Presentations: remind students of proper audience etiquette. Groups will present their “Talk Show” skits.

Reflection: I use this [resource](#) frequently when designing reflection activities. In this case, I would ask students to choose 2-3 questions upon which to focus in their written reflections. (Formative Assessment)

## Crew Earth Observation Webpage Guide

<b>ISS Science For Everyone</b>	<b>Answers/Notes</b>	<b>Vocabulary</b>
What does CEO stand for?		
How are observations captured?		
What can be learned from these observations?		
What is a major emphasis of CEO?		
Who benefits from CEO?		
<b>Experiment Description</b>		
How can human impact be documented?		Acquisition Payload
What steps are involved in the experiment?		Downlink Metadata
<b>Applications</b>		
Summarize the Space and Earth Applications.		
<b>Publications</b>		
What is spatial resolution?		Spectral Resolution Biomass
What spatial resolution have the ISS crewmembers achieved?		
How does the data gathered from CEO images of Pacific Ocean atolls demonstrate the accuracy of CEO images?		Atoll Bathymetry

What data can CEO photographs of cities at night provide?		
What are megafans? How have CEO images impacted the study of megafans?		Diversify Fragmentation Speciation Fluvial
What information can be gathered from CEO images of icebergs in the south Atlantic ocean?		Tabular Proxy Meltwater
Comment on the accuracy of night time imagery regarding the Operational Linescan System (OLS).		Impervious
What are sprites and how have CEO images contributed to their detection?		Transient Luminous Nadir (astronomy)

## **Exit Ticket**

List 3 observations you noted as you read the article, “Wow! The Life-Changing Power of Experiencing Profound Awe” by Christopher Bergland.

How can techniques used by astronauts aboard the ISS be used by people who suffer from depression and anxiety?

## CEO Scenario: “Talk Show” Skit

You are talk show hosts who’ve been assigned the following feature segment for your nightly news show:

A group of astronauts have just returned from a mission aboard the ISS. Conduct an interview providing them with the opportunity to describe their contributions to the CEO mission.

Your group of 4-5 members should be divided into reporters and astronauts. You must work together to create interview questions and answers. Your script will be evaluated and should therefore be your best work. You will use your notes and the webpage to develop your script. (Tip: ask clarifying questions to break down long answers.) You may include a visual aid, but you are not required to do so. Examples are a collage of CEO images or a running slide show of CEO images.

### Script criteria:

\_\_\_\_\_ Contains clearly worded questions designed to elicit responses and clearly worded answers regarding:

- \_ A brief overview of the CEO mission (5 points)
- \_ A description of at least two of the projects to which the astronauts contributed (be sure to mention the spatial ratio in regards to accuracy of images) (10 points)
- \_ The benefits of this type of work to scientists, the public, and the astronauts themselves (10 points)

\_\_\_\_\_ Gives each group member the opportunity to speak (5 points)

\_\_\_\_\_ Includes an introduction to the host(s), segment, and guest(s) (2 points)

\_\_\_\_\_ Includes a conclusion (thank guests, “Back to you in the studio!”) (2 points)

### Performance criteria:

\_\_\_\_\_ Participant spoke clearly (2 points)

\_\_\_\_\_ Participant spoke with enthusiasm and inflection (2 points)

\_\_\_\_\_ Participant maintained eye contact with the audience and host/guest (2 points)

\_\_\_\_\_ /40 Total Points

## References

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