

Teacher Tool 51: Rendezvous With A Comet

Study Guide

Study Guide for Space 12: Rendezvous with a Comet

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HEC-TV Live! Presents
Rendezvous With A Comet
Presented in Collaboration with Challenger Learning Center—St. Louis

Original Air Date: October 23, 2013

Grade Levels: 5-8

Program Description:

Join us in this archived program to be part of a simulated mission to rendezvous with Comet Encke. The program begins with students interacting in a space classroom experience with a comet expert and an expert from the Challenger Learning Center as they learn about comets and are updated on the mission currently in progress to Comet Encke.

As this opening learning activity is occurring, the space classroom experience is interrupted with news that the crew on its way to Comet Encke has encountered an unknown object. At that point students joining in the program become part of the mission as they get the opportunity to help the crew identify the unknown object and then achieve the new goals of a re-defined mission to launch a probe to explore that new object. Throughout the program, students use their scientific, problem-solving, and decision-making skills to deal with unexpected and highly unpredictable objects in the Solar System that come their way.

Information in the Program Format section of this document provides additional details on the content and activities included in the program. For purposes of the program, it is preferred that your students not know in advance that an unknown object will interrupt the mission thus giving them the opportunity to adjust to the changed circumstances similarly to the astronauts in the crew on their way to Comet Encke. Pre-program activity suggestions included later in this document will give you the opportunity to familiarize your students with topics and activities that are part of the re-defined mission section of the program, but we ask that you not reveal the event that will cause this information to be used.

Program Objectives:

Students will:

1. Engage in critical and creative thinking.
2. Gain an understanding of the importance of teamwork and communication to achieve success in group projects.
3. Use knowledge and apply skills, such as analyzing and interpreting data and graphing, to real-world situations.
4. Interact with real scientists to understand how and why they collect scientific data about comets.

Program Format:

The videoconference program will consist of the following segments. Student questions and comments will be welcomed throughout the program.

I. Background on the Mission and Astronaut/Expert Interaction—Student audience members and the general viewing audience “drop in” on the Comet Encke mission as it is occurring. We pick up the mission already in progress as we welcome everyone to the “space classroom experience.” This segment will include:

- A. Information about comets in general, Comet Encke specifically, and the nature of the mission the crew is on.
- B. Updates on what has occurred in the mission so far that will include video b roll and live pictures from the spacecraft and mission control.
- C. Analysis from comet expert, and Challenger Learning Center expert joining us for the program based on what has occurred in the mission so far and what we are seeing live at mission control and in the space craft.
- D. Question and answer session between students and the experts joining us for the program.

II. Mission Interrupted with Discovery of Unknown Object—The “space classroom experience” is interrupted as we hear warning siren of an unknown object in the path of the spacecraft. This segment includes:

- A. Live video from mission control and the spacecraft as we hear and see the discovery of the unknown object and crew reaction to it.
- B. Field reports from mission control.
- C. Analysis from the comet expert and Challenger Learning Center expert on what is happening and the need for a spectrum analysis of the unknown object.

III. Spectrum Analysis Activity—We announce that the planned space classroom experience for the day is being modified because of what the spacecraft has encountered and will now focus on the unidentified object. This segment includes:

- A. An interactive spectrum analysis activity to determine the nature of the unknown object. Options for the nature of the object are: planet, supernova, comet, asteroid, or meteor. Materials to be used by your students during the activity will be sent to you upon enrollment in the program.
- B. Students see video and visual images as they engage in the activity.
- C. Live cameras check in on the space capsule and mission control as students complete the activity with the expert(s) joining us.
- D. Students determine the nature of the object, and have a “check in” moment to compare that to what the mission control and spacecraft crews have determined for themselves.
- E. Question and answer session between students and the experts joining us for the program.

IV. The Redefined Mission Continues to the New Comet—As a result of their work in the spectrum analysis activity, students learn the new object is a previously undiscovered comet. Because of this discovery, NASA has modified the mission of the spacecraft and will now send the crew to rendezvous with the new comet and launch a probe to recover samples from it. This segment includes:

- A. An interactive triangulation/particle detection activity. This activity helps the mission's Navigation Team determine the best target location for the probe to intercept the comet and recover particles from it.
- B. Students see video and visual images as they engage in the activity.
- C. We check in with the mission control and spacecraft crews as they triangulate the location and compare results as needed.
- D. We also see live video from mission control and the spacecraft crew as they build the probe for the launch.
- E. Expert analysis from the Challenger Learning Center expert and comet expert is included as we engage in the triangulation/particle detection activity and watch the probe being built.
- F. Question and answer session between students and the experts joining us for the program.
- G. We watch the probe being launched.

V. Debriefing on the Mission and Final Questions—This segment includes:

- A. Debriefing with the comet expert and Challenger Learning Center expert on major concepts/topics/ideas, etc. learned today.
- B. Final questions from interactive groups.
- C. Thanks to all involved and Goodbye

Featured National and State Standards:

The program references a large number of **Common Core Standards** in the areas below. A complete list of the individual standards is included in the document entitled CommonCoreStd.doc available on the Program Materials web page for this program at <http://www.hectv.org/teachers/curriculum/hectv-live/rendezvous-with-a-comet-october-23-2013/>.

Reading Informational Text – Key Ideas and Details

Reading Informational Text – Craft and Structure

Writing – Text Types and Purposes

Writing – Research to Build and Present Knowledge

Writing – Production and Distribution of Writing

Speaking and Listening – Comprehension and Collaboration

History/Social Studies – Key Ideas and Details

History/Social Studies – Craft and Structure

Science and Technical Subjects – Key Ideas and Details

Science and Technical Subjects – Craft and Structure

Science and Technical Subjects – Integration of Knowledge and Ideas

Science and Technical Subjects – Range of Reading and Level of Text Complexity

Math – The Number System

Math – Expressions and Equations

Program-Related Activity Suggestions:

1. Questions About Comets?—Utilizing the web resources below and/or additional resources of your own, have students learn about comets in general and Comet Encke specifically. After completing their research, have students share with each other interesting facts they learned and questions they have about Comet Encke specifically or comets in general that they would have chosen to ask the experts joining us for the program.

<http://cometography.com/pcomets/002p.html> -- Discovery and historical highlights dealing with Comet Encke

<http://neo.jpl.nasa.gov/images/encke.html> -- NASA webpage with images of Comet Encke

<http://www.fallofathousandsuns.com/comet-encke.html> -- Website with information on Comet Encke's discovery, orbital period, upcoming return, orbital path, diameter, and potential historic contact with Earth

<http://theskylive.com/encke-tracker> -- Webpage showing Comet Encke's current position in the sky

<http://spaceplace.nasa.gov/comet-nucleus/> -- NASA webpage with information on a comet's nucleus

http://starchild.gsfc.nasa.gov/docs/StarChild/solar_system_level2/comets.html -- NASA webpage with general information about comets including video resources

<http://solarsystem.nasa.gov/planets/profile.cfm?Object=Comets&Display=Kids> -- NASA webpage with general information about comets including featured NASA missions to comets

2. Questions About Manned Space Flight?—The mission your students are participating in includes humans flying in a space ship to intercept a comet. Utilizing the NASA website below and/or resources of your own, have students learn about the effects on humans from going into space. After completing their research, have students share with each other interesting facts they learned and questions they have about humans in space that they would have chosen to ask the experts joining us the program.

http://www.nasa.gov/externalflash/HRP_Feature/

3. What is a “Spectral Analysis?”—The mission your students are participating in includes an interactive Spectrum Analysis activity to identify the type of unknown object that has been encountered by the astronauts. To give your students some background information on spectral analysis, utilize the information on the NASA web page below.

http://imagine.gsfc.nasa.gov/docs/science/how_11/spectral.html

5. What is Triangulation?—The mission your students are participating in includes an interactive triangulation activity to determine the best location on the comet to target for the probe that will be launched to it. To give your students some background information on triangulation and how it is used both on earth and in space, utilize the information on the web pages below.

<http://www.qrg.northwestern.edu/projects/vss/docs/navigation/1-what-is-triangulation.html>

<http://www.qrg.northwestern.edu/projects/vss/docs/navigation/1-how-do-we-know-location.html>

6. Can a Probe Land on a Comet?—One aspect of the mission your students are participating in

has astronauts launching a probe to the newly discovered comet to retrieve samples from it. Is such an experiment possible? Watch the video below that describes NASA plans to do just that in an upcoming mission to a comet. Should your students have questions about how this might work, consider including them in the three to five “burning questions” you submit to us by October 15 to live@hectv.org per the information included in Participant Preparation #3 and #4 above.

<http://www.youtube.com/watch?v=hTEkuiuZrAc>

Vocabulary Words:

The following terms will be used in the program. Students may wish to familiarize themselves with the terms prior to the program.

Density

Eccentricity

Magnitude

Perihelion

Spectrum

Triangulation

Supplemental Resources:

In addition to the web resources included in the pre-program activity suggestions and post program activity suggestions, teacher and student materials related to the program can also be found on our HEC-TV website at <http://www.hectv.org/video/12877/rendezvous-with-a-comet-october-23-2013/> and <http://www.hectv.org/teachers/curriculum/hectv-live/rendezvous-with-a-comet-october-23-2013/>.

For more information about the Challenger Learning Center St. Louis, go to their website at <http://www.elcstlouis.org/>.