



Generation Beyond Virtual Field Trip Educator Companion Guide

Overview

Join us live in Silicon Valley to celebrate Space Week! We will go behind the scenes to look at two different cutting-edge facilities – the Lockheed Martin Space System’s Advanced Technology Center in Palo Alto, CA where over 500 scientists and technicians are conducting research daily to study the sun and understand its impact on Earth. Then we will head over to Lockheed Martin’s Solar Array Facility in Sunnyvale, CA – home to the construction of more than 850 solar array panels and over 90 thousand square feet of solar cells.

The pre-field trip activities in this companion guide have been designed to introduce students to the topics they will learn about and the during and post-field trip activities have been designed to connect and extend student learning to classroom concepts.

Students will:

- identify STEM careers that match their skills, interests, and experiences.
- examine innovations and technologies that gather data to solve problems.

National Standards:

Next Generation Science Standards

ESS3.A: Natural Resources

Humans depend on Earth’s land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (MS-ESS3-1)

Standards for Technological Literacy Standard

17: Students will develop an understanding of and be able to select and use information and communication technologies.

M. Information and communication systems allow information to be transferred from human to human, human to machine, machine to human, and machine to machine.

Materials:

Index cards

Applying Your Knowledge and Skills to Careers in Aerospace capture sheet

Aerospace Technologies capture sheet

Satellite Telemetry capture sheet

Solar Energy Business Plan capture sheet



Before the Virtual Field Trip

4-Corners Question Boot up

Before you begin your journey, see what students already know about solar energy. Designate one corner of the room to represent each response. You might want to use small white boards or signs to label each corner. State the question and ask students to write their response on an index card. Then, ask students to take their cards to the designated corner. Direct students to form groups of 2-3 and share why they selected this option. Repeat directions for each question and reveal correct answers.

1. Which of the following can be run on solar power?
 - Transportation
 - Wearable Technologies
 - Outdoor Lighting
 - Satellites(all are correct)
2. What is the device that converts sunlight directly into electricity called?
 - Photosynthetic
 - Photovoltaic (correct answer)
 - Photosynthesis
 - Photo-converters
3. Sunlight is composed of which type of energy particle?
 - Photons (correct answer)
 - Electrons
 - Neutrons
 - Neutrino
4. The Greeks and Chinese were the first civilizations to build their structures to maximize light and heat energy. Which direction did they face their buildings? (Both civilizations are North of the equator)
 - South (correct answer)
 - East
 - West
 - North

Key Vocabulary

- **Solar array** – absorb the sunlight as a source of energy to generate electricity or heat
- **Photovoltaic** – power system designed to supply useable solar power
- **Solar cell, or photovoltaic cell** – electrical device that converts light energy into electricity



During the Field Trip

Activity 1: Applying Your Knowledge and Skills to Careers in Aerospace

Guide students to brainstorm their personal talents and interests and write them on the capture sheet. Then, direct students to watch the Virtual Field Trip. While they watch, they should look to match some of their talents and interests with the careers featured.

Activity 2: Aerospace Technologies

Students will use the analogy sentence starters to analyze the technologies featured in the different career spotlights. Students will compare a technology they are familiar with to one they will observe during different segments of the VFT. After the VFT, students will use the second column sentence starters to evaluate and summarize the technologies they observed.

After the Virtual Field Trip

Activity 1: Generation Beyond Video Challenge

Lockheed Martin is seeking creative and innovative ideas for the design of a deep space habitation module with the Generation Beyond Video Challenge. If your students haven't entered the challenge, this is their chance! Students will present their Mars mission habitation module through a one- to two-minute video, which must include a visual representation of the habitation module. More details and information can be found at www.generationbeyondinschool.com/challenge. Entries are due by 12/14/17.

Activity 2: Satellite Telemetry

Satellite telemetry is used to view Earth from space. Orbiting satellites allow us to follow objects on Earth's surface and is a powerful research tool for scientists and engineers. Students will investigate a specific real-world application of satellite telemetry and capture their learning using the provided handout.

Possible examples include the following:

- Making topographic maps
- Studying and tracking animal migration
- Surveying areas after natural disasters
- Forecasting weather
- Monitoring agriculture

Activity 3: Solar Business

Solar power is energy from the sun and is considered a major source of energy because it is freely available and can be harnessed by modern technology. Students will work in small groups of 2-3 and select an application of solar energy and think through a simple business plan. Students will evaluate the use of solar power for their specific business request.

Possible examples include the following:

- Solar powered tent
- Solar powered furniture
- Solar powered backpack
- Solar powered athletic bag
- Solar powered game



Applying Your Knowledge and Skills to Careers in Aerospace

Careers in aerospace work together to develop aircraft, spacecraft, satellites, and missiles. The excitement about innovations and human exploration result in strong job opportunities in this area. Your interests, abilities, and goals all influence your career choices.

What are your talents and skills? List at least four.

What are interests or hobbies you enjoy? List at least four.

While watching the Virtual Field Trip, match some of your talents and interests related to each career highlighted.

	Solar Array Facility	Solar Dynamics Lab	Solar and Astrophysics Laboratory	List two careers that best match to your talents and/or interests
List two skills the professional highlighted as being critical to their work.				
List two talents or interests that you have related to this job.				



Aerospace Technologies

Complete the first column of the graphic organizer below as you watch the Virtual Field Trip. Each video segment identifies a specific innovation that functions in a similar way to an everyday technology. Complete the second column after the Virtual Field Trip to summarize your learning.

During the Virtual Field Trip	After the Virtual Field Trip
<p>Solar Array Facility</p> <p>Augmented Reality is used in popular games by _____, just like the Solar Array Lab uses Augmented Reality to improve product flow by _____.</p> <p>Solar Dynamics Lab</p> <p>Magnifying glasses are used in class to _____, just like the Interface Region Imaging Spectrograph (IRIS) works to _____.</p> <p>Solar and Astrophysics Laboratory</p> <p>Weather stations are used to _____, just like the Solar Ultraviolet Imager works to _____.</p>	<p>I observed professionals using innovative solutions by _____.</p> <p>I expected to see _____, but I also saw _____.</p> <p>I was really surprised when _____.</p> <p>This Virtual Field Trip relates to the things we have been learning in class because _____.</p> <p>I would like to learn more about _____.</p>



Satellite Telemetry

Orbiting satellites allow us to follow objects on Earth’s surface and is a powerful research tool for scientists and engineers. You will investigate a specific real-world application of satellite telemetry to examine how it is helping us gather data to solve problems.

Identify and explain the topic	
List the types of data collected from satellites	
Explain how this data helps us solve real-world problems	
Who can benefit from this application of satellites?	



Solar Energy Business Plan

Solar power is energy from the sun and is considered a major source of energy because it is freely available and can be harnessed by modern technology. Solar cells are devices that convert light energy directly into electrical energy. Solar cells are also called photovoltaic cells. You may have seen smaller versions of these to power calculators or larger cells to power street signs. In this activity, you will select an application of solar energy and think through a simple business plan.

Which solution did you choose for the business request? _____

What do you want your design to do? _____

Who is the main audience for your design solution? _____

Draw the prototype to be built (label with functionality, location of photovoltaic cells, and materials)

What are three advantages of using solar power in your design?
