

Christine Cote  
5E Lesson Plan - Draft

**Topic -**

Epic Challenge - Creating a sustainable human habitat on Mars

**Title -**

Introduction to Mars Surface

**Grade Levels -**

10 - 12

**NGSS and Massachusetts State Standards**

**Set Up - Time and Place:**

The lesson will take place in the classroom using the desktop computers. It will take approximately 6 class periods.

**Background -**

Each year the students in the Epic Challenge program are presented with a challenge that NASA is currently working to solve. This year, the challenge is to create something that could be utilized in the creation of a sustainable human habitat on Mars. After the students study the planet and developments in space exploration, they will choose a topic of research that they will focus on for the remainder of the school year. The students will then communicate with experts in their field of interest to inquire about mentoring possibilities and/or opinions on their research proposals. Their research will culminate in a presentation at a student symposium at the Kennedy Space Center in June 2019.

**Justification -**

The students will first need to understand why Mars is a viable option for a space colony. By studying the satellite imagery and using the data in the JMARS system, the students will be able to calculate the size of craters and other geological formations. They will also be able to determine if there are areas more suitable for supporting a habitat by the types of land formations and terrain visible in the regions they are studying. The landscape will factor into their designs for the habitat and JMARS will be invaluable in providing them this essential data.

**Objectives -**

- Students will study the surface of Mars using the JMARS database.
- Students will log into JMARS and learn the different layer features ( surface temperature, thermal imagery of the landscape, MOLA, day and night

observations, etc) in the software program which will provide detailed information from satellite observations.

- Students will be able to identify landforms and geological features and formulate scientific theories as to how they were formed.
- Students will complete the study packet identifying the different types of geological formations and craters.
- Students will create a scale to demonstrate size and proportion of the formations they have studied.
- Students will use the data learned to create a proposal for a Martian habitat.

### **Materials -**

Student Packet

Pencil

Ruler

Calculator

Computer with Internet Access

[JMARS](#) software program

[THEMIS](#) images (provided by Arizona State University - these can be accessed online at the JMARS/ASU website)

### **Engage -**

To spark the students' curiosity, we will watch a video on the proposal of a Mars Mission that has been submitted to NASA and the government.

[https://www.youtube.com/watch?time\\_continue=2&v=Zw2fycH-Avc](https://www.youtube.com/watch?time_continue=2&v=Zw2fycH-Avc)

Following the video, we will have a class discussion on why we should investigate Mars.

I will ask the students -

Following the lunar landing in 1969, the video states that the US had the technology to go onto Mars in the early 1970s. Why do you think the mission to Mars had not been widely accepted?

What are the challenges facing the astronauts travelling in space for long periods of time?

Do you feel there is any benefit in creating a colony on Mars?

The students will write a brief essay entitled "Why Mars" and will elaborate on their viewpoint whether we should inhabit Mars based on the information they obtained in the film.

### **Explore -**

The students will be introduced to the [THEMIS](#) images which depict various regions on the surface of Mars and display various land types and formations. We will go over the software and I will demonstrate the different layers that can be added to the satellite images which will provide detailed information on specific regions.

The students will then be able to log onto the program and begin exploring the surface of Mars and locate the areas shown in the THEMIS images.

### **Explain -**

The students will work in teams (3-4 students) to complete a student packet which prompts them to choose an area on the surface of Mars and identify all the features visible in the satellite image of that particular area.

[http://marsed.mars.asu.edu/sites/default/files/stem\\_resources/SM\\_MARS\\_IMAGE\\_ANALYSIS\\_2\\_16.pdf](http://marsed.mars.asu.edu/sites/default/files/stem_resources/SM_MARS_IMAGE_ANALYSIS_2_16.pdf)

### **Elaborate/Extend -**

The students will be able to explore the surface on the software and compare the data collected in the stamp collection. These snapshots provide a timestamp with valuable information and may show any changes in landforms or regions over an extended time period.

This study will help them in the selection of a location for a settlement and/or future rover landing.

### **Evaluate -**

The students will create a slide presentation explaining why certain features may be beneficial in the creation of a human colony. They will also provide a theory as to how these features may have been created. If there are areas that may be a hindrance to a successful landing or habitation then the students should address these as well.

### **References -**

<https://jmars.asu.edu/>

<https://docs.google.com/document/d/1VRkrGWztAZF8wV-uXwz8ek115H89NJO7YJlphpsl8Ec/edit?usp=sharing>

[https://docs.google.com/document/d/1CKVQc-\\_VJYEg\\_SkoTmfC32ATF17k2bASdjl0P-Tzvtc/edit?usp=sharing](https://docs.google.com/document/d/1CKVQc-_VJYEg_SkoTmfC32ATF17k2bASdjl0P-Tzvtc/edit?usp=sharing)

