

High School Engineering Lesson AI in Aerospace

STUDENT HANDOUT



Name

Date

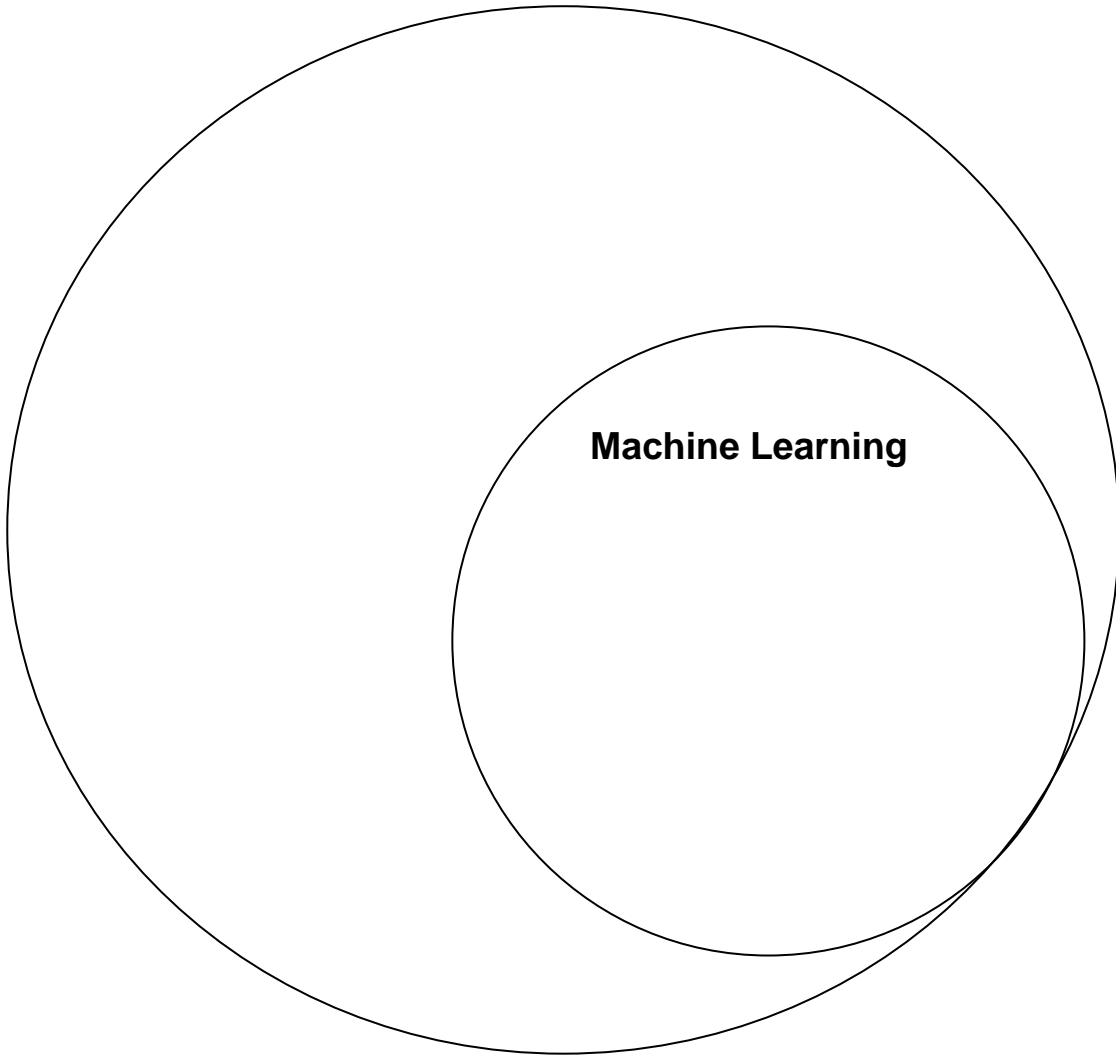
Directions: Students read the prompts and answer in complete sentences in the box to the right.

Part 1: Understanding AI Around Us

Section B: What is Machine Learning?

Complete the diagram below to break down the relationship between AI and Machine Learning.

Artificial Intelligence (A.I.)



Section C: Mini-Activity, "Where is AI?!"

What are some examples of AI or Machine Learning that you have seen in school?

What are some examples of AI or Machine Learning that you have seen at home?


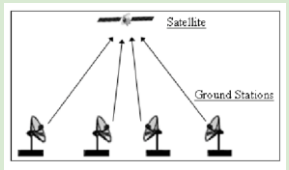
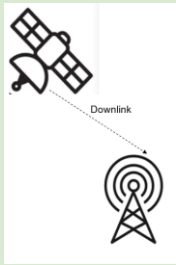
Day 2: How do Satellites "Wave?"

Section F: How do Satellites Wave?

Using the terms and definitions below, draw a diagram to show how humans on Earth are able to navigate with GPS (global position system) using their cell phones.

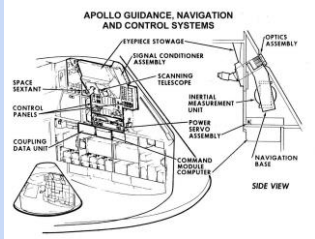
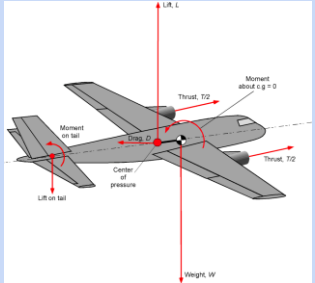



- **Satellite:** A man-made or natural object that moves around a larger object.
- **Ground Station:** A technological station placed on Earth or in space to collect and stream satellite data.
- **Receiver:** Is the destination that receives the communication or data from the satellite.

Section G: Vocabulary Development

Word	Definition	Image	Description or Analogy in Your Own Words
Satellite	Something that orbits a large object in orbit/space		
Uplink	Transmission of signal from ground (Earth) to satellite in space		
Downlink	Transmission of signal from satellite in space to ground station (Earth)		

Ground Stations	Designation station on Earth that receives and sends signals to satellites in orbit/space.		
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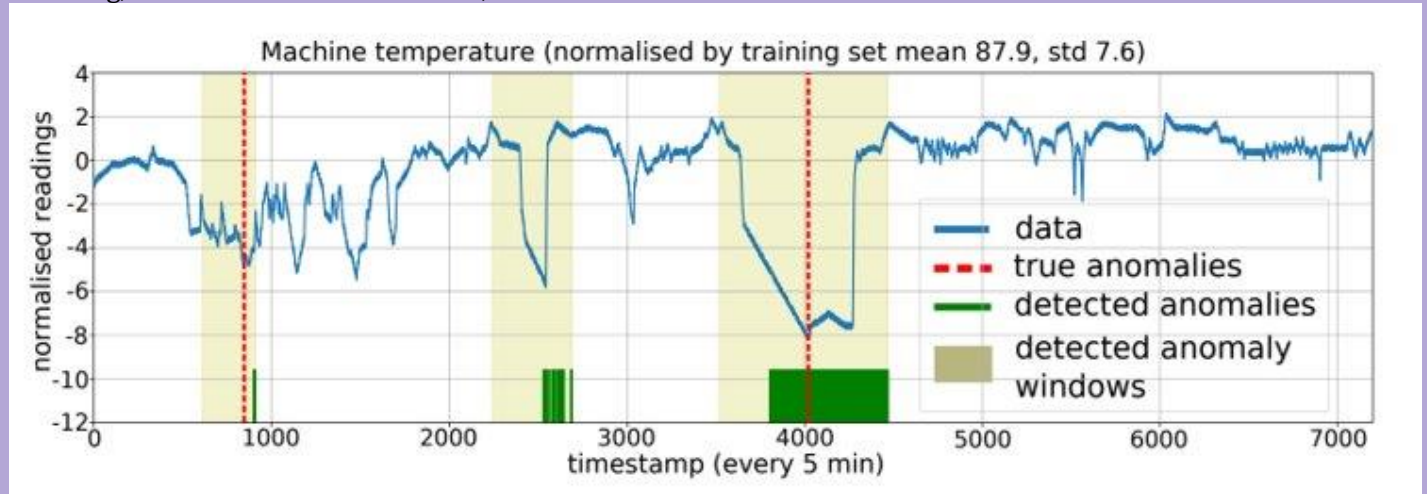
Day 3: I Wear Many Hats

Section I: Vocabulary Development: Careers			
Word	Definition	Image	Description or Analogy in Your Own Words
Guidance, Navigation and Control Engineer	Designs, manufactures, and tests systems for aircraft spacecraft.		
Flight Dynamics Officer/ Engineer	Responsible for trajectories, flight paths, and orbital mechanics. Makes sure all parts follow the correct path and physics		
Systems Engineer	Works with all teams, manufacturers, and designs to ensure product works as advertised.		
Communication Engineer/ Specialist	Researches and designs methods of communication in space with Earth		
Computational Analyst	Calculates how much memory, data, and what type of data/computer processing will be needed for scenarios		

Day 4: Error Codes

Section J: Introduction to Challenges in Space

Observe the graph below. Record what you notice, wonder, and connections you can make to AI, Machine Learning, how satellites communicate, and the STEM careers involved.



Notice

Wonder

Connections to AI, Machine Learning, how satellites communicate, and the STEM careers.

Section K: Introduction to Challenges in Space Continued

<p>1. Brainstorm ideas of what might cause a rocket engine to have a sudden decrease in temperature.</p>	
<p>2. What are some other errors that satellites could experience in space?</p>	
<p>Match the error code with the professional(s):</p> <ul style="list-style-type: none"> ○ Guidance, Navigation and Control Engineer ○ Flight Dynamics Officer/ Engineer ○ Systems Engineer ○ Communication Engineer/ Specialist ○ Computational Analyst 	
<p>a. Acceleration issues</p>	
<p>b. Overheating</p>	
<p>c. Running low on fuel</p>	
<p>d. Power error</p>	
<p>e. Thermal error</p>	
<p>f. Communications delay</p>	
<p>g. Software malfunction</p>	

Day 5: Solve the Code. Save the World!

Section L: Introduction to Solve the Code Game

Scenario:

The world is in danger! A satellite has malfunctioned, causing it to send out four mysterious error codes, disrupting communication with other satellites and jeopardizing important missions.

As natural problem solvers, your team of brilliant scientists and engineers knows that you will need to step up and embark on a mission to resolve the error codes and restore communication.

You and your team quickly realize that to solve such a big problem, you will need the help of an Artificial Intelligence in the laboratory to check your progress to resolve the problem.

Your team will encounter four error codes; a jumble of numbers and symbols, a series of binary numbers, complex mathematical equations, and finally an encrypted top secret message.

When each code is solved, team members will check the answers with the located AI in the room. The AI can let your team know if your answer is correct or incorrect. Please note the AI can not explain to your team why your answer is wrong or right. When each code is solved, the team will be one step closer to the satellite's systems coming back online, and communication with other satellites will be restored.

Section M: Play the Game!

Solve the following four codes. When your team has resolved an error in a code, go to the located AI in the room to check your work. Remember, the AI can not tell you what you have done wrong, only if your team is correct or incorrect!

When your team has solved all four codes, you have restored communication in the satellite and your team has saved the world!

Code 1:

12#34%56&78*90



Error Message: Oops! Looks like there's a mistake in the code

Error for Code 1:

Correct Code:

Code 2:

$$\begin{aligned} \heartsuit + \text{🌻} &= ? \\ \text{🌊} / \text{🌻} &= ? \\ \text{🐼} \times \text{🍉} &= ? \end{aligned}$$

Error Message: That's a mistake! Emojis have replaced digits, solve the formulas.

1	2	3	4	5	6	7	8	9
								

Error in Code 3:

Correct Code:

Code 3:

Message: OCEJKPG NGCTKPI

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B

Error Message: Oops, message has been intercepted! Send a decrypted message to grant access.

Caesar Cipher: A type of cipher that shifts letters in a message to make it unreadable if intercepted. To decrypt, reverses the shift.

2 letter shift : K=I

Decrypted Message:

Section N: Debrief and Reflection

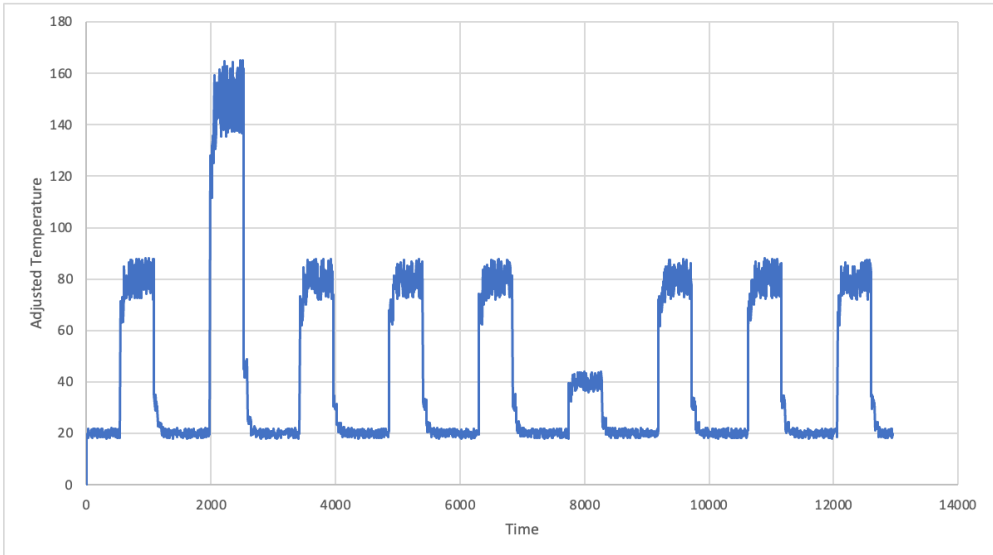
1. Was your team able to solve all codes?

2. What were your team's strengths? Weaknesses? Do you feel your team was able to communicate and collaborate together effectively?

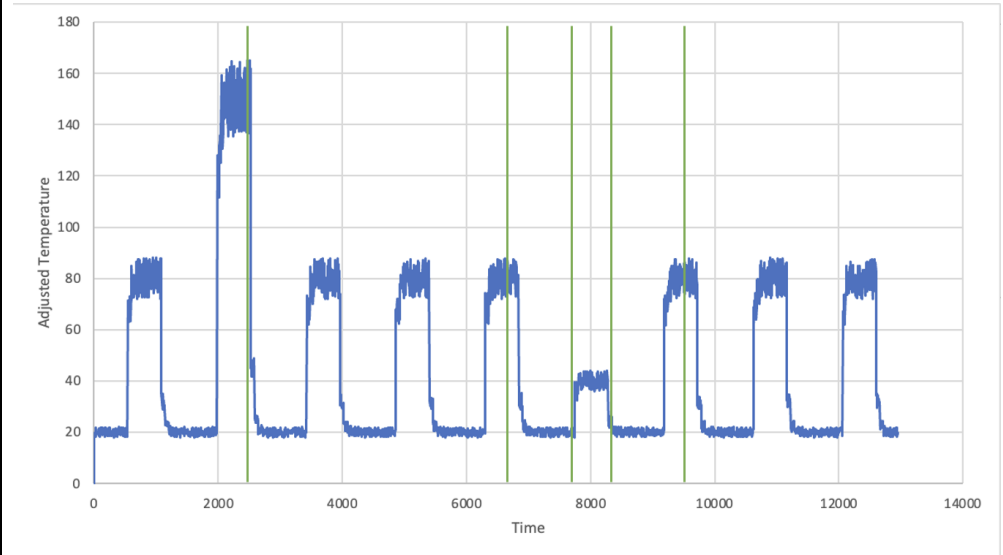
<p>3. How was the role of AI useful? What would have made it more useful?</p>	
<p>4. What was the value of using human interactions in this activity instead of relying solely on AI?</p>	
<p>5. If you could program the AI in the room to learn from these codes, what would be the next most logical step to teach?</p>	
<p>6. How might this type of machine learning be useful in an aerospace environment?</p>	

Section 0 - Apply to Data

Be the AI and determine the anomaly regions in the data.



Machine Learning has identified the green lines as detected anomalies and you have narrowed those down to true anomalies at 2500, 9500, and 6775. Mark the true anomalies in red and highlight where an error most likely occurred on the graph to the right.



Given that this data was obtained from a telescope attached to a satellite in low earth orbit, who (what type of engineer) would you alert the error to and what type of error are they looking at?