

## DIRECTIONS

1. Catalogue the mysterious events using the calendar below.
2. Use the calendar of events, along with the artifacts below to find evidence for what may have caused the mysterious events. Use the hints provided to guide you along the way.

September 6	September 7
September 8	September 9

# ARTIFACTS

## Artifact #1: "Internet Research"

You've done some research and have come across the following chart:

Coronal Mass Ejections	Solar Flares
Release explosions of magnetic field, protons and electrons (matter)	Release electromagnetic radiation
Particles take 2-3 days to reach Earth	Travels at the speed of light; takes 8 minutes to reach Earth
Carries a magnetic field that can interact with Earth's magnetic field.	Increase in EM radiation can cause disruptions in radio communications and GPS

**Evidence :**

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**Hint:** How long does it take CME particles and Solar Flare energy to reach Earth?

## Artifact #2: "Military Satellite Report"

Sept. 5 - Normal

Sept 6 - Alert

**12:01pm** - Increase in X-ray and gamma ray levels detected. Defense system on alert: Def Con 3.

**12:11pm** - Increased X-rays and gamma rays identified as not coming from Earth. Defense system taken off alert.

**12:34pm** - Communications with all other nuclear powers confirm that no detonation of nuclear weapons occurred.

**11:59pm** X-ray and Gamma-ray levels returned to normal

Sept. 7 - Normal

Sept. 8 - Normal

**Evidence :**

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**Hint:** On what day and times did the alert occur? When was the increase in rays detected?

**Artifact #3: "Hourly Record of Sept 6th Solar Flares and CMEs"**

S = small

M = Medium

L = Large

Time	Solar Flares			Coronal Mass Ejection		
	S	M	L	S	M	L
00:00 - 00:59	1					
01:00 - 01:59		1			1	
02:00 - 02:59						
03:00 - 03:59		1				
04:00 - 04:59		1			1	
05:00 - 05:59						
06:00 - 06:59						
07:00 - 07:59	1					
08:00 - 08:59						
09:00 - 09:59		1				
10:00 - 10:59	1					
11:00 - 11:59			1			1
12:00 - 12:59	1					
13:00 - 13:59	1					
14:00 - 14:59						
15:00 - 15:59						
16:00 - 16:59	1			1		
17:00 - 17:59	1	1			1	
18:00 - 18:59						
19:00 - 19:59						
20:00 - 20:59	1					
21:00 - 21:59						
22:00 - 22:59						
23:00 - 23:59						

Flare Data from [www.solarmonitor.org/?date=20170906](http://www.solarmonitor.org/?date=20170906)

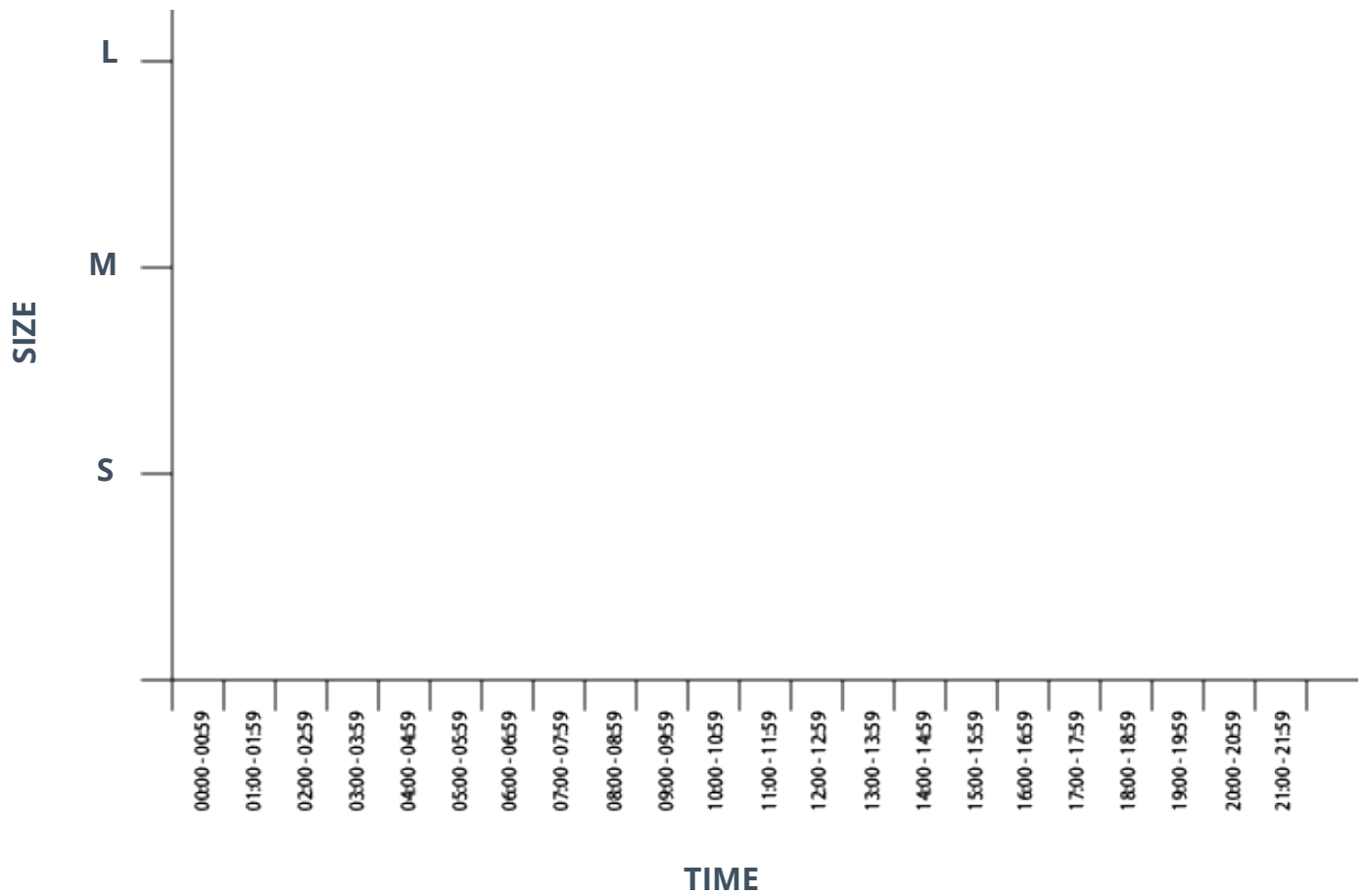
**Evidence :**

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**Hint:** At what time did the largest CME and Solar Flare occur?

# GRAPH THE DATA FROM ARTIFACT #3

Graph Title \_\_\_\_\_



- = Solar Flare
- = Coronal Mass Ejection

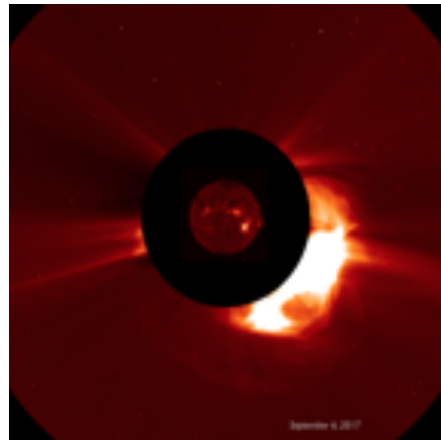
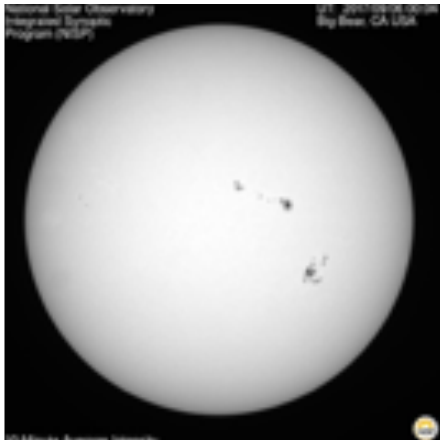
**Artifact #4: Sunspot and CME observations**

**Date**

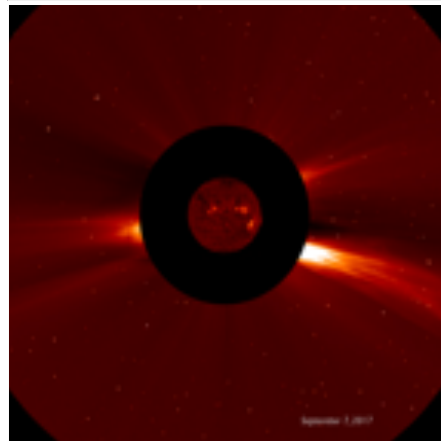
**Sunspot activity**

**CME activity**

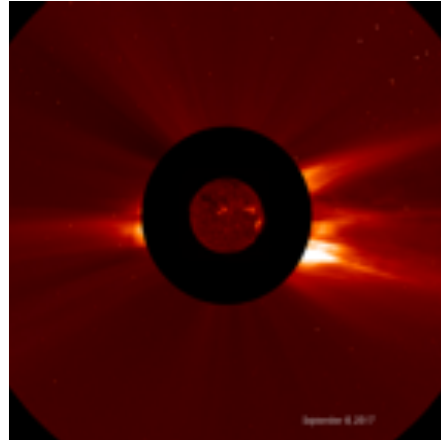
Sept. 6



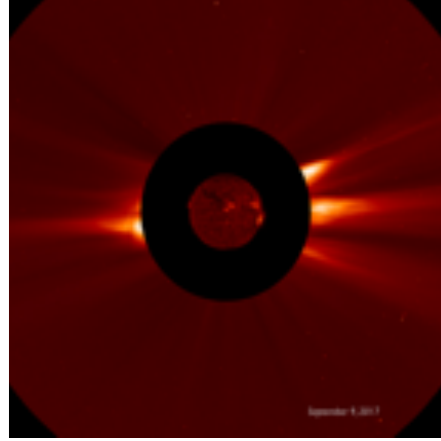
Sept. 7



Sept. 8



Sept. 9



**Evidence :**

**Hint:** On what day does the CME activity look different?

## CONCLUSIONS

### Questions:

1. What was the cause of all of these disruptions?

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2. The largest solar flare on Sept 6th happened at 11:53am. Why did the loss of radio communications at Earth not happen until 12:01pm?

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3. If the largest solar flare and CMEs occurred on Sept 6th, what explains the disturbances that happened on Sept 8th?

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**Write your conclusions in the space below. Be sure to explain what caused the events and provide specific examples of evidences that validate your conclusions. Use what you know about solar flares and CMEs in your explanation.**

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