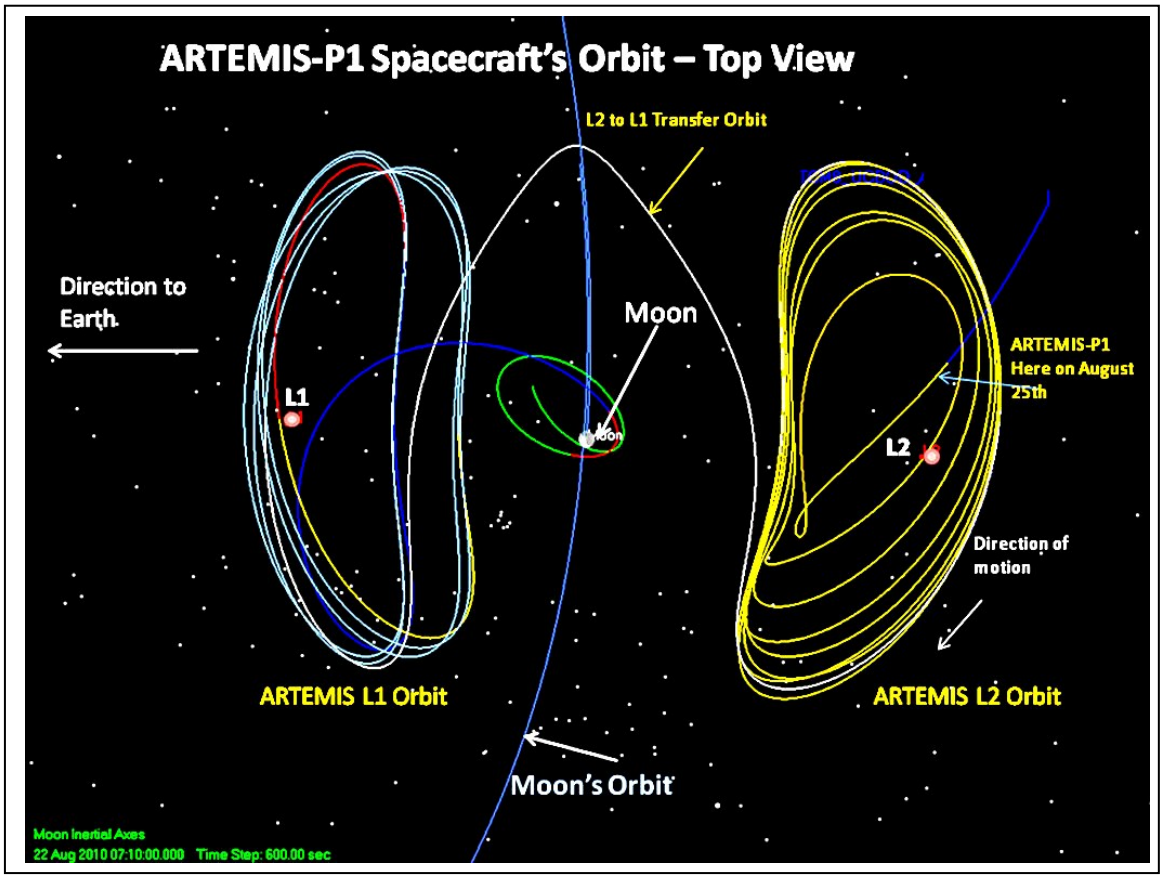

The Artemis spacecraft, formerly P1 of the THEMIS constellation in Earth orbit, has been reprogrammed to journey to lunar orbit to continue making measurements of Earth's magnetic field. Once there, it will perform a complicated orbit between two 'invisible' points in space called the L1 and L2 Lagrange Points. These are locations within the combined gravitational forces of the Earth and Moon and spacecraft centrifugal forces are in near-equilibrium. The spacecraft can remain more or less at the same location with only minor use of its maneuvering rockets.

Problem 1 – The distance between L1 and L2 in the diagram above is 120,000 kilometers. Using a millimeter ruler, what is the scale of this figure in kilometers/millimeter?

Problem 2 – Using a piece of string and measuring to the nearest meter in length, about what is the total length of the spacecraft orbit shown in the figure in millions of kilometers?

Problem 3 – Assume that the average speed of the spacecraft in its travels is about 200 meters/sec. How long, in days, will it take the spacecraft to 'fly' the orbit pattern A) Around one of the Lagrange Points? B) Around the full orbital circuit shown above?

Problem 1 – The distance between L1 and L2 in the diagram above is 120,000 kilometers. Using a millimeter ruler, what is the scale of this figure in kilometers/millimeter?

Answer: The L1 and L2 points are 80 mm apart on the figure, so the scale is 120,000 km/80 mm = **1,500 km/mm**.

Problem 2 – Using a piece of string and measuring to the nearest meter in length, about what is the total length of the spacecraft orbit shown in the figure in millions of kilometers?

Answer: Depending on how students lay down the string along the indicated path the length should be about 2 meters. At the scale of the diagram, this is equivalent to **3 million kilometers.**

Problem 3 – Assume that the average speed of the spacecraft in its travels is about 200 meter/sec. How long, in days, will it take the spacecraft to 'fly' the orbit pattern A) Around one of the Lagrange points? B) Around the full orbital circuit shown above?

Answer:

A) The loop around L1 is about 150 mm, so the distance is about 225,000 kilometers. At a speed of 0.2 km/sec, a full loop will take about 1,100,000 seconds or since there are 86,400 seconds in 1 day, about **13 days**.

B) To travel 3 million kilometers at 0.2 km/sec will take about **170 days**.