



Note: This file can not replace watching the video lecture. Because the video lecture contains more explanation through graphical elaboration.



Certified Junior Astronaut Training Course

Origin of Satellites and their roles (Part 3)





This lecture will answer the following inquiry:



How did the idea of a Satellite originate? Why?





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The idea of a satellite originated from the arms race between the United States of America and Russia in the 1950s after World War II due to the focus on space invasion. There were some attempts to launch rockets carrying electronic equipment for various purposes. Scientists' efforts have succeeded in developing these rockets to put bodies in space called Artificial Satellites. The USA was terrified that Russia may use these satellites as launchers that mount bombs or nuclear and chemical heads. The first Russian satellite was launched in 1957; followed by the USA success in 1958, and then other countries.



Various Scenes from the year 1957





Cont.. How did the idea of a Satellite originate? Why?

Russian Sputnik-1 Satellite:

It was the first satellite ever launched to space on October 4, 1957. It was a bright metal ball of a 58 cm diameter and it weighed 83 Kg. It carried communication devices connected to the ground station. Its objective was to test the capability of launching a satellite and positioning it in its orbit in the space; in addition to gathering information about the atmosphere's density and sending radio waves to earth. Waves have continued to be transmitted to earth for 22 days until the satellite's batteries went dead.



Source: The Fever Of 57



Cont.. How did the idea of a Satellite originate? Why?

Russian Sputnik-2 Satellite :

- ✚ It represents the second satellite that was launched to space on November 3, 1957. Its objective was to test the space influences on the presence of a living being in space (Laika, the dog) and to conduct the required measurements for securing the normal movement and cycle of the living being in space. Over and above, the satellite was carrying sensors to measure sun rays and cosmic rays.



Source: The Fever Of 57



Cont.. How did the idea of a Satellite originate? Why?

It's strange that although the first satellite was launched in 1957, the laws that govern the movement of satellite was discovered by the German scientist "Kepler" 300 years earlier; despite the absence of technology or even electricity at that time that allow manufacturing or launching satellites. Kepler has discovered three laws that govern the earth rotation and other planets located in the galaxy around the sun. These laws were known as Kepler's first, second and third laws; it is also known that the same laws that applied to the previous case are the same laws that applied to the rotation movement of any small object (such as the satellite) around a large object with gravity (such as the earth). This similarity between the two previous cases is shown in the following example.





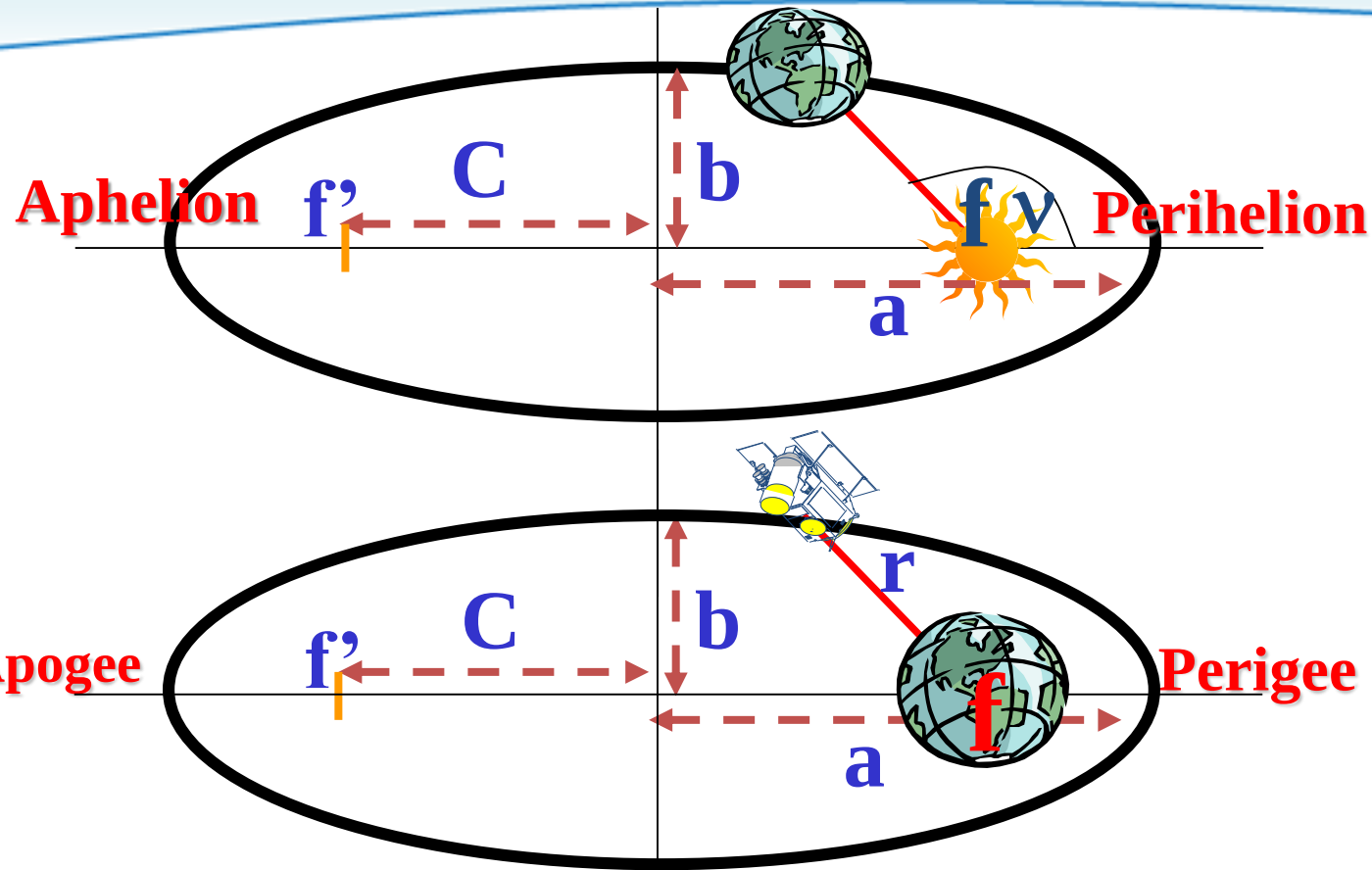
Cont.. How did the idea of a Satellite originate? Why?

Kepler's first law states that the planets are orbiting the sun in a path described as an ellipse. The sun is located in the first center of the ellipse which has the symbol f ; while the second center f' is empty.

The same law applies to satellite rotation around earth; where earth is located in f ; while f' is empty.

The nearest point to earth called Perigee and the farthest point is known as Apogee. The distance between the center of the earth and the satellite is r ; it is calculated using the following formula:

$$r = [a (1 - e^2)] / [1 + e \cos v]$$



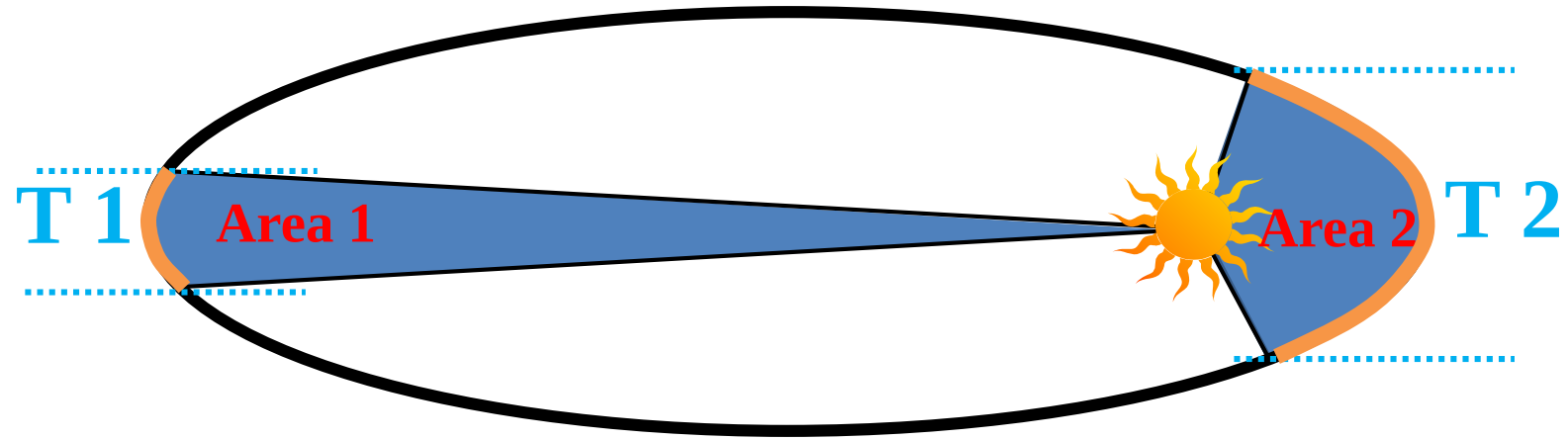
a : Semi major axis b : Semi minor axis
 C : Semi distance between focii
 v : True anomaly (Position of satellite in orbit)
 e : Eccentricity = c/a



Cont.. How did the idea of a Satellite originate? Why?

✚ Kepler's second law states that if the area of location A1 is equal to the area of location A2, then the time consumed to travel the distance T1 is equal to the time consumed to travel the distance T2.

✚ We can deduce that a satellite moves fastest when it is closest to the earth and slowest when it is farthest from earth. This is with the exception of circular orbits where its distance from the earth is fixed.



If Area 1 = Area 2 Then Time 1 = Time 2

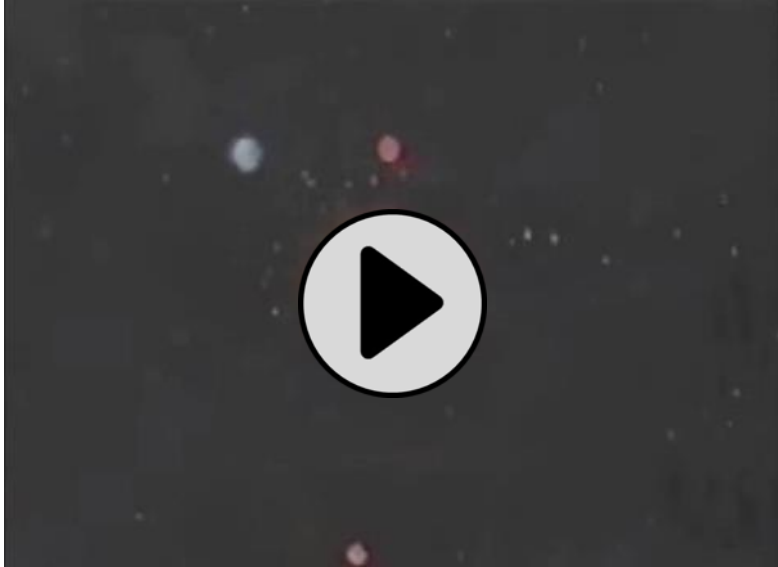


Cont.. How did the idea of a Satellite originate? Why?

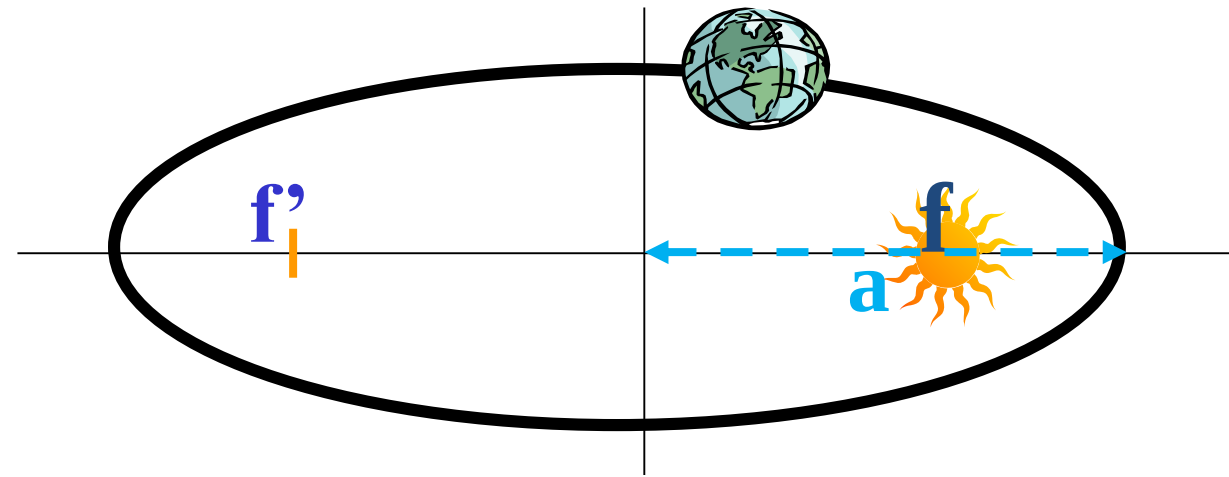
- Kepler's third law aims to find a relation in order to calculate the time of a complete cycle of a planet around the sun or of satellites around earth. The law states that the square of the orbital period of a planet is proportional to the cube of the semi-major axis of its orbit shown in the figure with the letter "a".

$$\frac{P^2}{a^3} = \text{constant for all Planets}$$

Where P is Orbital Period



Source: Freedom University





Thanks for your undivided attention

