



Get the Data

Visit EOSS <http://1.usa.gov/H0OFGP> to recreate this exact scene. Recommended operating system: MS Vista or later; Browser: MS Internet Explorer 8 or later.

Step 1 – Click on the ‘Visual Controls’ tab and make sure that the following items are selected with a ‘white spot’: stars, planetary bodies, spacecraft, and metric.

Step 2 – Click on the Destination menu tab. Click on ‘Spacecraft’ and ‘Earth Missions’. Select a mission to study its spacecraft geometric shape.

Answering Questions

Problem 1 – The Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) was launched in 2006 to study how clouds and aerosols affect Earth's climate. The spacecraft is a cylinder 1 meter in diameter and 2.5 meters long. What is its volume in cubic meters?

Problem 2 – The Kepler satellite is a telescope that searches for planets orbiting other stars. Its main component is a cylinder with a diameter of 1.4 meters and a length of about 4.5 meters. What is its volume in cubic meters?

Math Challenge

The Hubble Space Telescope, shown above, is a telescope with a cylindrical shape that is 13.2 meters long and has a 2.4-meter in diameter mirror. The spacecraft diameter is 4.2 meters. Suppose astronomers wanted to design a new space telescope, but where the volume of the satellite had to be limited to 300 cubic meters. What would be the largest diameter mirror that could be used in the new design?

Answer Key

9

Problem 1 – The Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) was launched in 2006 to study how clouds and aerosols affect Earth's climate. The spacecraft is a cylinder 1 meter in diameter and 2.5 meters long. What is its volume in cubic meters?

Answer: The radius of the base is 0.5 meters so $V = 3.141 (2.5)(0.5)^2 = \mathbf{2.0 \text{ cubic meters}}$.

Problem 2 – The Kepler satellite is a telescope that searches for planets orbiting other stars. Its main component is a cylinder with a diameter of 1.4 meters and a length of about 4.5 meters. What is its volume in cubic meters?

Answer: The radius is 0.7 meters, so the cylindrical volume is just $V = 3.14 (4.5)(0.7)^2$ or **6.9 cubic meters**.

The Hubble Space Telescope, shown above, is a telescope with a cylindrical shape that is 13.2 meters long and has a 2.4-meter in diameter mirror. The spacecraft diameter is 4.2 meters. Suppose astronomers wanted to design a new space telescope, but where the volume of the satellite had to be limited to 300 cubic meters. What would be the largest diameter mirror that could be used in the new design?

Answer: The dimensions of the satellite cylinder are a length of 13.2 meters and a radius of 2.1 meters. The volume is just $V = 3.14 (13.2)(2.1)^2 = 182.8$ cubic meters. We want to increase this to 300 cubic meters. This is a volume increase by a factor of 1.64 times. Since we want to increase the height and the radius by the same factor to achieve this new volume, the increase in the radius and height needs to be a factor of $(1.64)^{1/3} = 1.18$ times. Note that this increases the volume by $(1.18)(1.18)^2 = 1.64$ which is the desired volume increase. So, the diameter of the new satellite will be $4.2 \times 1.18 = 5.0$ meters. Since the proportion of the diameter of the satellite occupied by the mirror was $4.2/2.4 = 1.75$, the new mirror will have a proportionate diameter of $5.0 \text{ meters}/1.75 = \mathbf{2.9 \text{ meters}}$.