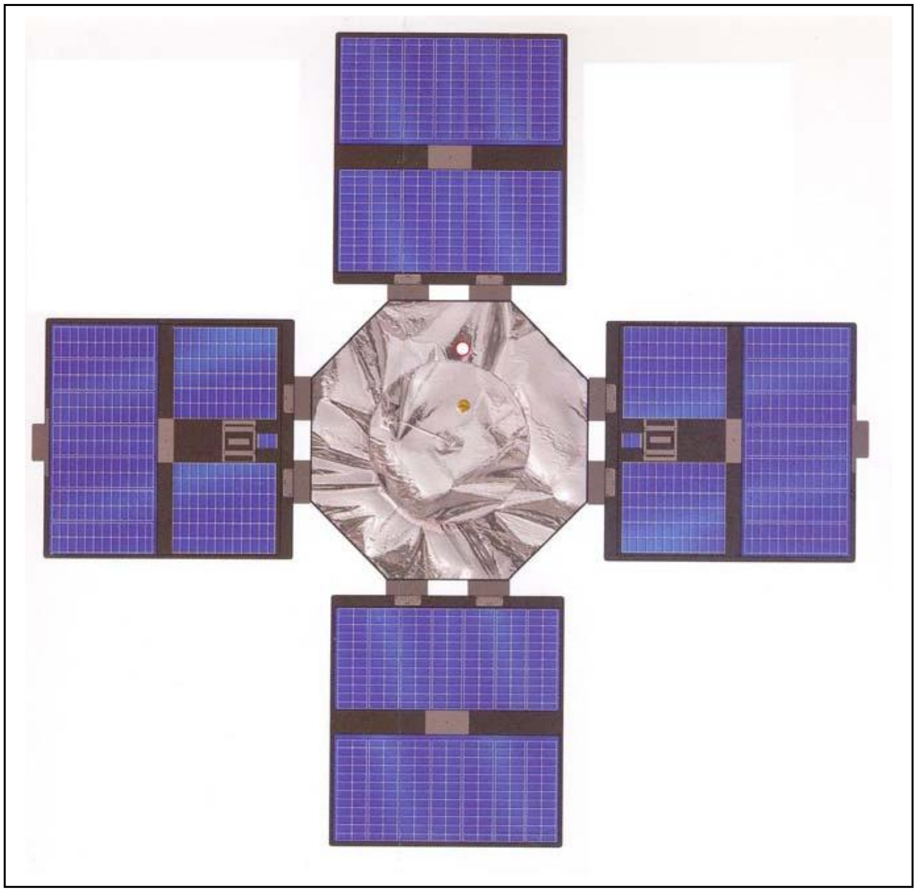
Electricity from Sunlight: The Van Allen Probes Solar Panels



NASA's twin Van Allen Probes spacecraft will be launched in 2012. The figure above shows the octagonal spacecraft body and the location of the surrounding four solar panel 'wings' that provide power to the spacecraft instruments. The small blue rectangles within each of the four solar panels show the location of the solar cells used to power the satellite. As the spacecraft orbits Earth, the four solar panels continuously face the sun to provide constant power.

Problem 1 – Using a millimeter ruler to measure the (silver) octagonal satellite body in the above figure, and the fact that the actual top-to-bottom height of the octagon is 2.0 meters, what is the scale of this figure in centimeters/millimeter?

Problem 2 –What is the total area of the 10 solar cells in square-meters?

Problem 3 – The amount of electrical power generated by a solar panel is 0.0077 watts/cm^2. What is the total power generated by the four solar panels on one Van Allen Probes satellite to the nearest hundred watts?

Problem 1 – Using a millimeter ruler to measure the (silver) octagonal satellite body in the above figure, and the fact that the actual top-to-bottom height of the octagon is 2.0 meters, what is the scale of this figure in centimeters/millimeter?

Answer: If you print this problem on a standard '8.5x11' page, the top-to-bottom length is 37 millimeters. This corresponds to 2 meters or 200 cm, so the scale is 200 cm/37mm = **5.4 cm/mm**.

Problem 2 –What is the total area of the 10 solar cells to the nearest tenth of a square-meter?

Answer: The 5 large rectangles have dimensions of 29mm x 13mm, and the 5 small rectangles measure 13mm x 12mm, so their actual dimensions are 157cm x 70 cm, and 70cm x 65cm. The total area is 5(157x70) + 5(70x65) = 77,700 cm^2. Since 1 meter = 100 cm, the area in square-meters is just 77700 cm^2 x (1 m/100 cm)(1m/100cm) = 7.77 $meters^2$, or to the nearest tenth of a square-meter we get **7.8 $meters^2$.**

Problem 3 – The amount of electrical power generated by a solar panel is 0.0077 $watts/cm^2$. What is the total power generated by the four solar panels on one RBSP satellite to the nearest hundred watts?

Answer: In square centimeters, the total area of the solar panels is 78,000 cm^2. The electrical power produced is then P = 0.0077 $watts/cm^2$ x (78000 cm^2) = **600 watts**.