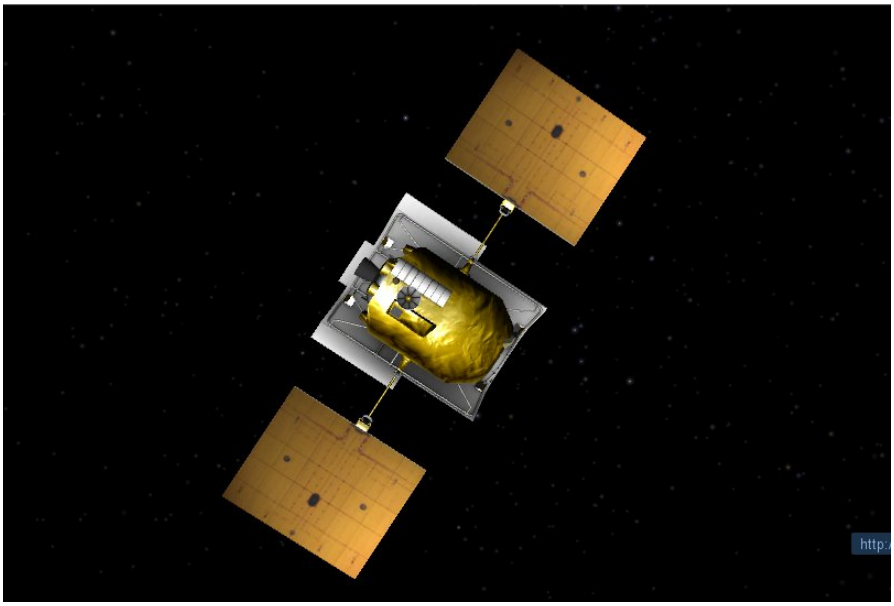
Eye Spy – Exploring Mercury with the MESSENGER Spacecraft



Get the Data

Visit EOSS **http://1.usa.gov/NefhH8** to recreate the scene above. 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': spacecraft, planets, labels, orbit lines, trails and metric.

Step 2 – Click and depress your left 'mouse' button and with the button depressed, move the cursor to rotate and shift the scene so that you can explore the shape of the spacecraft from many different perspectives.

Answering Questions

On August 3, 2004 the MErcury Surface, Space ENvironment, GEochemistry and Ranging (MESSENGER) spacecraft was launched on a complex path that eventually led to the spacecraft orbiting Mercury on March 18, 2011. During the next year, it took 100,000 images of Mercury's surface.

Problem 1 – The MESSENGER Narrow-Angle Camera (NAC) can resolve surface details of 20 meters/pixel at its closest distance of 200 km. From its farthest orbit distance of 15,000 km, what is the smallest feature it can discern in meters/pixel?

Math Challenge

Mercury is located 46 million km from the sun, and Earth is located 147 million km from the sun. As viewed from Earth, the angular diameter of the sun in the sky is 0.5 degrees. What will be the angular diameter of the Sun as viewed from the MESSENGER spacecraft and Mercury?

Answer Key

Problem 1 – The MESSENGER Narrow-Angle Camera (NAC) can resolve surface details of 20 meters/pixel at its closest distance of 200 km. From its farthest orbit distance of 15,000 km, what is the smallest feature it can discern in meters/pixel?

Answer: Solve this problem by recognizing that the pixel angle remains the same and we are working with two similar triangles with sides 20 meters and 200 km, and X meters and 15000 km. Then solve the proportion:

20/200 = X/1500 to get 20 meters/pixel x (15000/200) = 15,000 meters/pixel or **15 kilometers.**

Challenge Problem: Mercury is located 46 million km from the sun, and Earth is located 147 million km from the sun. As viewed from Earth, the angular diameter of the sun in the sky is 0.5 degrees. What will be the angular diameter of the Sun as viewed from the MESSENGER spacecraft and Mercury?

Answer: In this case we use the principle that as you **increase** the distance to an object, its apparent size becomes **smaller** so the inverse proportion will be:

The proportion is: X = 0.5 degrees x (147 million /46 million) = **1.6 degrees**.

Note that the area of the sky occupied by the sun near Mercury has $(1.6/0.5)^2$ = 10 times the sky area, so this means that 10 times more heat energy will be delivered to an exposed surface, making it much hotter.