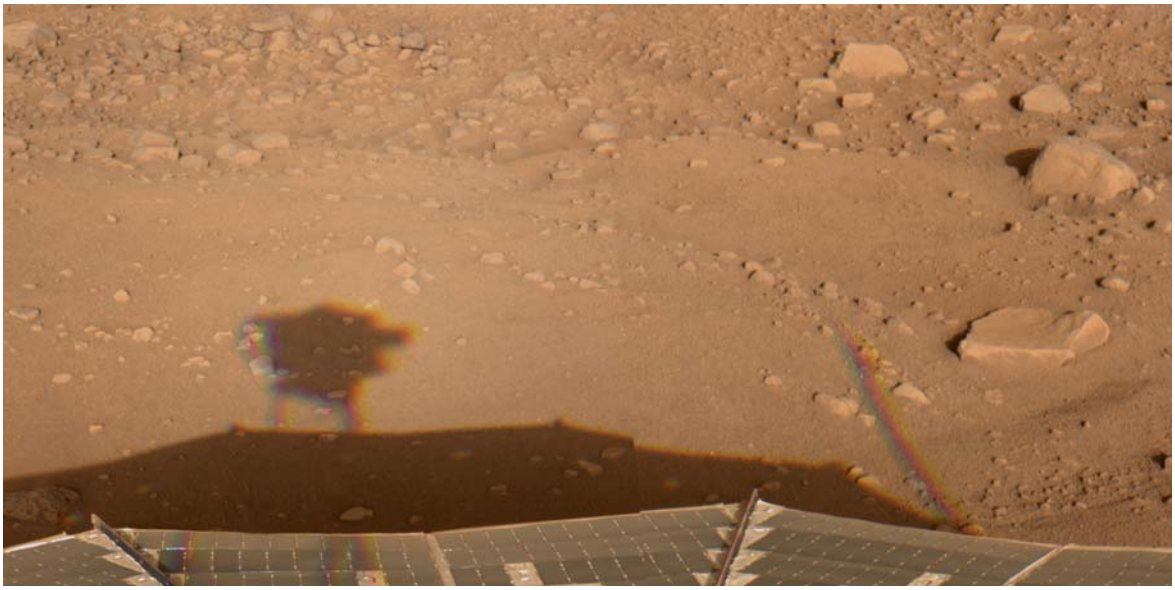


The InSight lander will arrive at Mars on September 20, 2016. One of its first jobs will be to photograph a three square meter area in front of the lander where the Seismic Experiment for Interior Structure (SEIS) and the Heat Flow and Physical Properties Package (HP^3) will be deposited with a mechanical arm. The photo above was taken by the successful NASA Phoenix Lander in 2008 using a similar camera system.

The InSight camera system called IDC is a digital camera with a one megapixel square format (1024x1024 pixels). Each pixel can see a square area of the surface that is 0.82 milliradians on each side.

Problem 1 - If one radian is 57.296 degrees, how many arcseconds across is the angular resolution of one pixel?

Problem 2 - What is the width of the camera's field of view in degrees: A) along one side of the image? B) Along the diagonal of the image?

Problem 3 - At a height of one meter from the ground, what is the resolution of the camera in millimeters/pixel?

Problem 4 - If the area to survey is 1.6 meters x 2.4 meters, and each image must overlap 50% of the previous image, how many images have to be taken by the camera to survey the entire instrument area?

Problem 1 - If one radian is 57.296 degrees, how many arcseconds across is the angular resolution of one pixel?

Answer: 0.82 milliradians x (1 radian/1000 milli) x (57.296 degrees/1 radian) x (3600 seconds/1 degree) = **169 arcseconds/pixel.**

Problem 2 - What is the width of the camera's field of view in degrees: A) along one side of the image? B) Along the diagonal of the image?

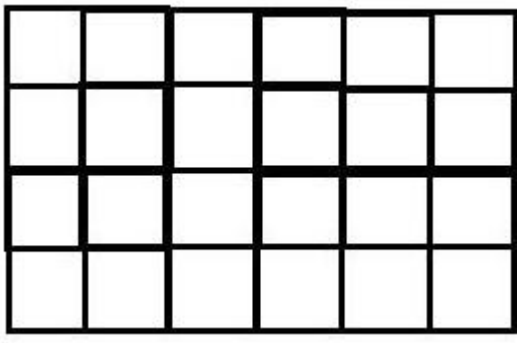
Answer: A) Width = 1024 pixels x 169 arcseconds/pixel x (1 degree/3600 seconds) = **48.1 degrees**. B) The image is a square, so the hypotenuse is 1.414 x side, and so the diagonal length is 1.414 x 48.1 degrees = **68 degrees**.

Problem 3 - At a height of one meter from the ground, what is the resolution of the camera in millimeters/pixel?

Answer: Because the angle is much less than one degree, we use the 'skinny triangle' proportion which says that $x/L = \theta / 1\text{radian}$ and so since 169 arcseconds = 0.00082 radians we have x = I meter x 0.00082 so x = **0.82 millimeters per pixel**.

Problem 4 - If the area to survey is 1.6 meters x 2.4 meters, and each image must overlap 50% of the previous image, how many images have to be taken by the camera to survey the entire instrument area?

Answer: Each square image has a side length of 1024 pixels x 0.00082 meters or 0.82 meters. The surface has a width of 1.6 meters and a length of 2.4 meters. If you tiled this field with camera images, you would need a tiling of 2 x 3 images or 6 images with no overlap. For a 50% overlap, the figure below shows how this would work out.



It would take three images vertically and 5 images horizontally for a total of **15 images**.