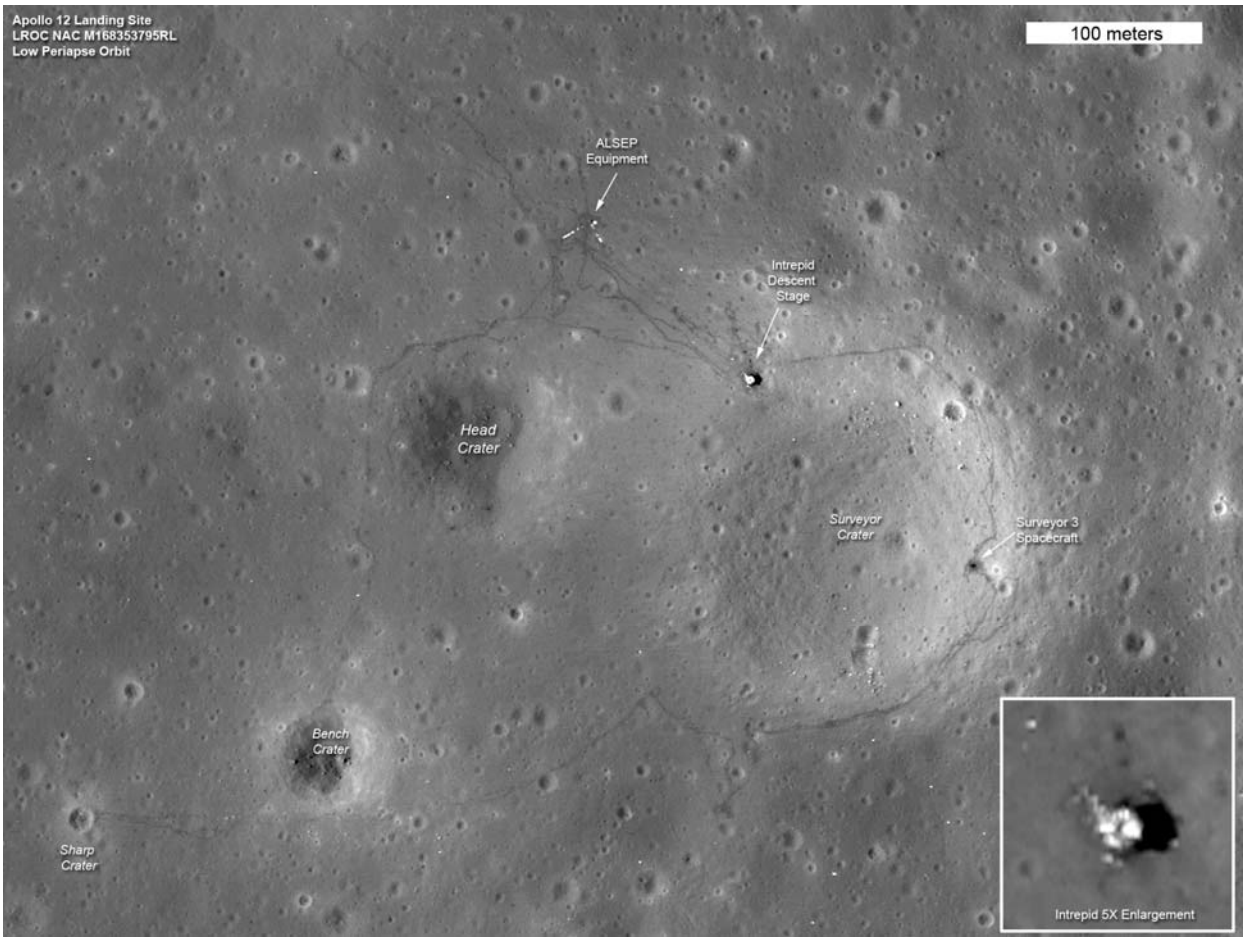

NASA's Lunar Reconnaissance Orbiter (LRO) from a lunar orbit of 21 kilometers (13 miles) captured the sharpest images ever taken from space of the Apollo 12 landing site. Images show the twists and turns of the paths made when the astronauts explored the lunar surface. One of the details that shows up is a bright L-shape in the Apollo 12 image. It marks the locations of cables running from the Apollo Lunar Surface Experiments Package (ALSEP) central station to two of its instruments. Although the cables are much too small for direct viewing, they show up because they reflect light very well.

Problem 1 – Following one of the walking paths, about how many meters did the astronauts have to walk from A) the ALSEP to the Descent Stage, and then around Surveyor Crater to finally reach the Surveyor spacecraft? B) The Surveyor spacecraft to Sharp Crater?

Problem 2 – Using your favorite method, about how many craters can you see across this entire area?

Problem 3 - If the craters were created over a period of about 3 billion years, about what may have been the average time between impacts to form the craters you see?

Problem 1 – Following one of the walking paths, about how many meters did the astronauts have to walk from A) the ALSEP to the Descent Stage, and then around Surveyor Crater to finally reach the Surveyor spacecraft? B) The Surveyor spacecraft to Sharp Crater?

Answer: Print out the problem on a typical laser printer and measure the '100 meter' bar with a millimeter ruler. An answer of about 23 millimeters yields an image scale of abouy 100 meters/23 mm = 4.3 meters/mm.

A) Using a piece of string or a millimeter ruler, measure the segments of the thin black 'track' that astronauts took. An answer of about 90 millimeters will be adequate. Using the image scale of 4.3 meters/mm you will get a distance of 90 mm x (4.3 m/mm) = 387 meters. This can be rounded to **390 meters**.

B) Measuring the track segments, a string length of about 200 millimeters is adequate. From the scale factor, this equals a physical distance of 200 x 4.3 = **860 meters** traveled.

Problem 2 – Using your favorite method, about how many craters can you see across this entire area?

Answer: Divide the area into a grid of squares. Count the number of craters you can see in one square, and multiply by the total number of squares. For example, if you make the squares 40mm x 40mm, you can fit 4 columns and 3 rows. Selecting the one in the second column, first row, you can count about 80 craters (from 0.5 to 2 millimeters across on the image) so the total number of craters is about 80 x 12 = 960 craters. **Answers between 800 and 1100 are also reasonable estimates.**

Note: From the image scale, the most common craters range in size from 0.2 millimeters to 2 millimeters, which corresponds to an actual size between 0.9 meters and 8.6 meters.

Problem 3 - If the craters were created over a period of about 3 billion years, about what may have been the average time between impacts to form the craters you see?

Answer: If we select 1000 craters as the average estimate, then the rate of cratering is about 1000 craters / 3 billion years or **1 crater every 3 million years**.

For more information about these images, see the NASA press release at:

NASA Spacecraft Images Offer Sharper Views of Apollo Landing Sites
Sep 6, 2011

http://www.nasa.gov/mission_pages/LRO/news/apollo-sites.html