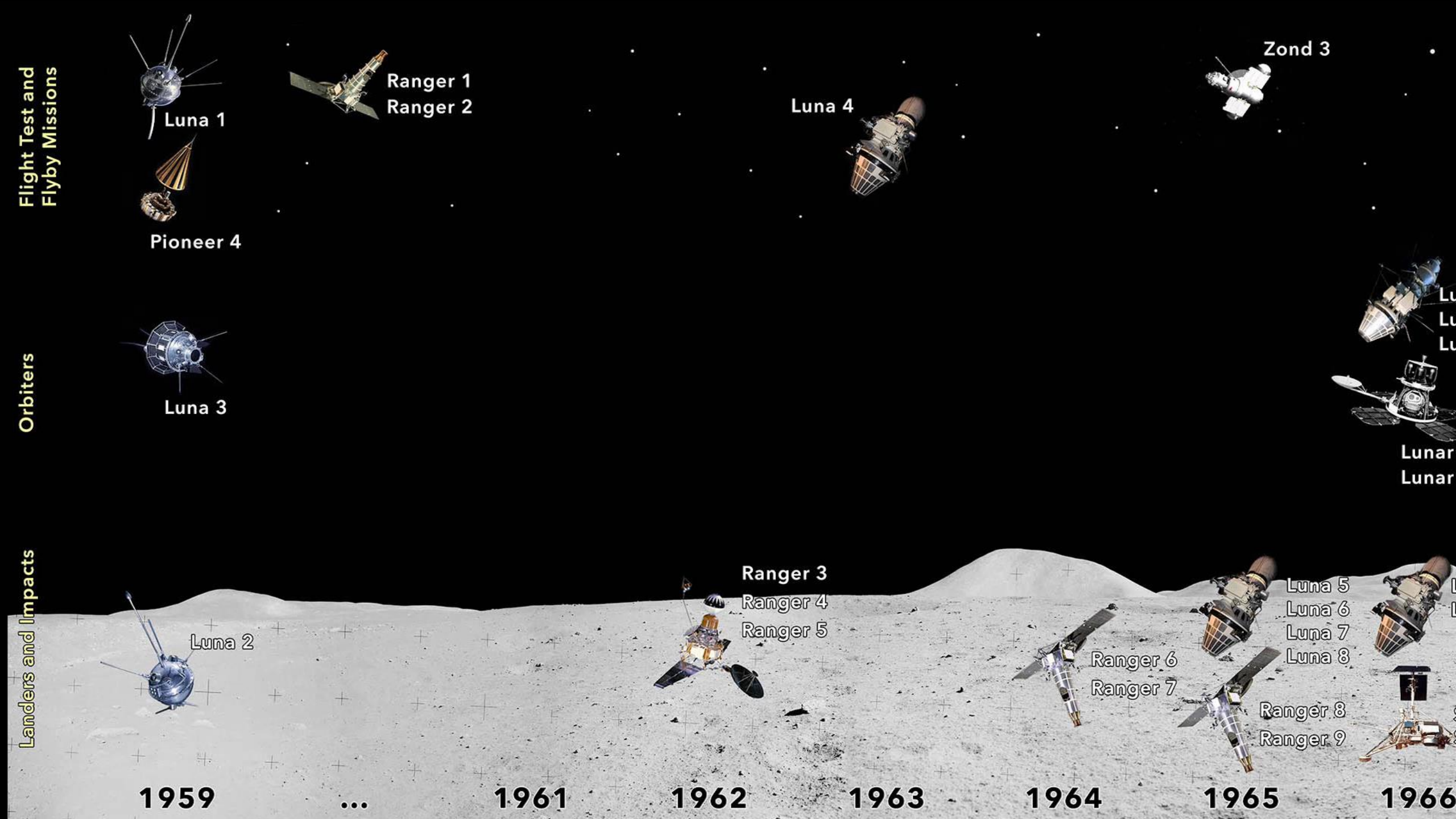
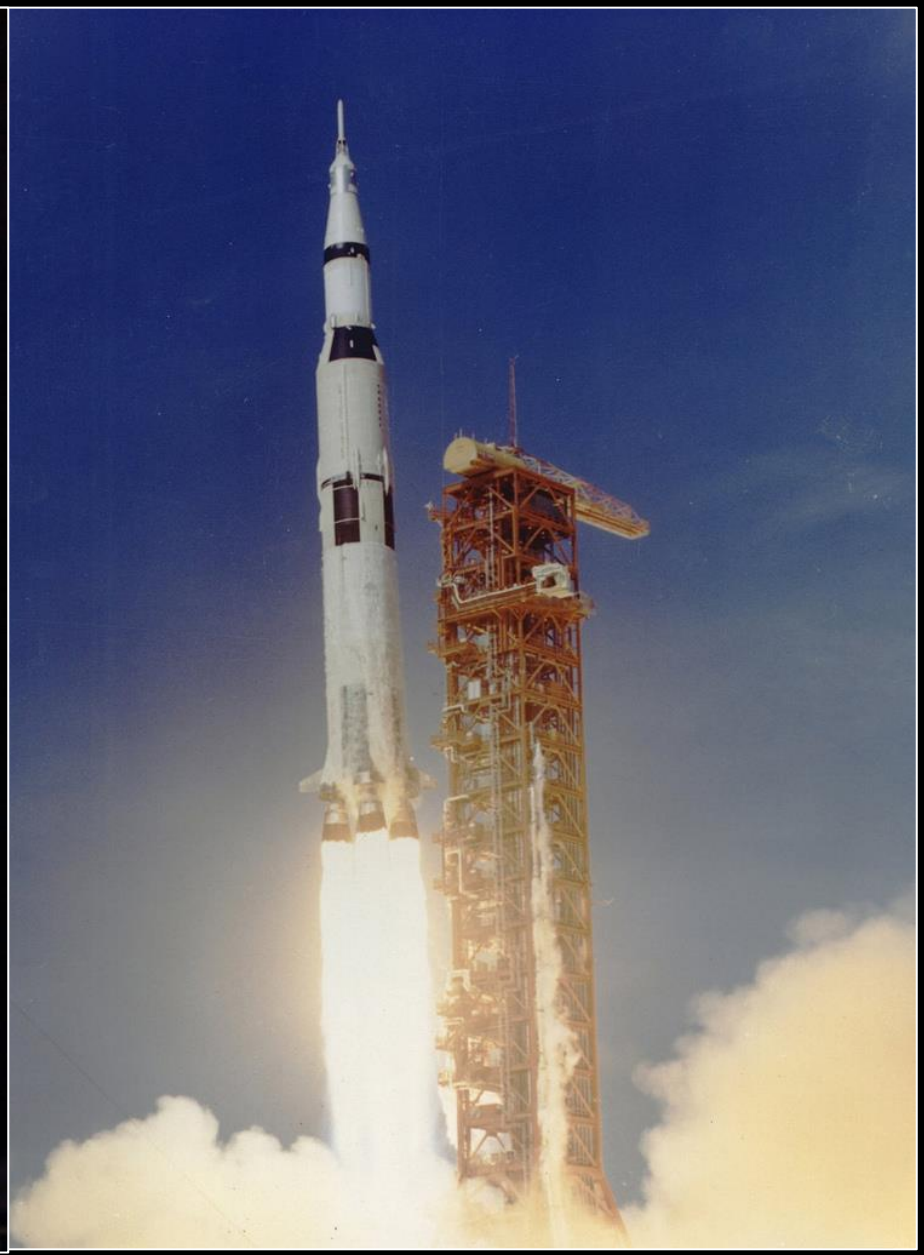
Moon Trek
https://trek.nasa.gov/moon

Future City Competition – Living on the Moon

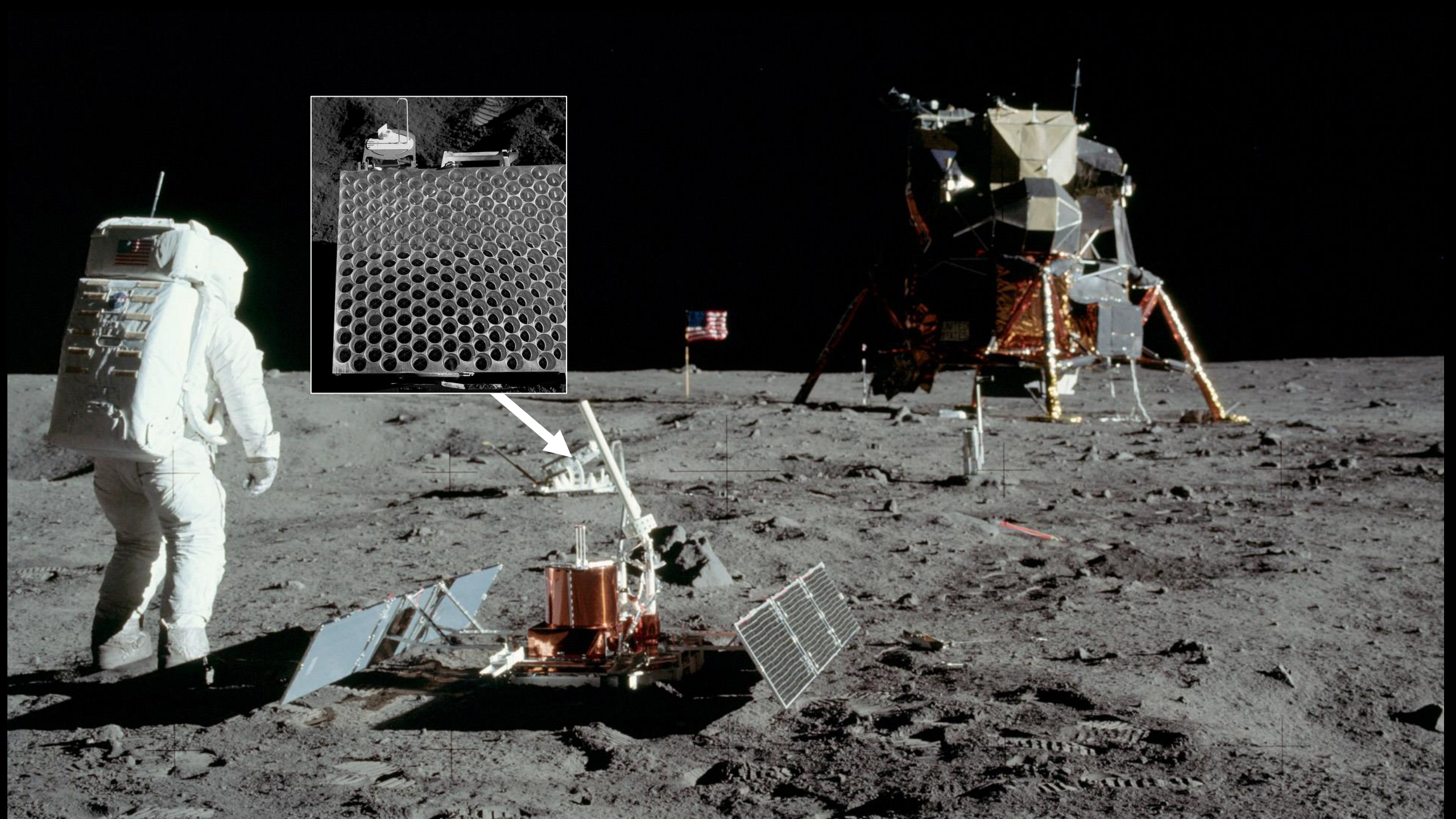
Emily Law, NASA Jet Propulsion Laboratory
<emily.law@jpl.nasa,gov>


Flight Test and Flyby Missions
Orbiters
Landers and Impacts
Luna 1
Ranger 1
Ranger 2
Luna 4
Zond 3
Pioneer 4
Luna 3
Ranger 3
Ranger 4
Ranger 5
Luna 2
Ranger 6
Ranger 7
Luna 5
Luna 6
Luna 7
Luna 8
Ranger 8
Ranger 9
1959
...
1961
1962
1963
1964
1965
1966

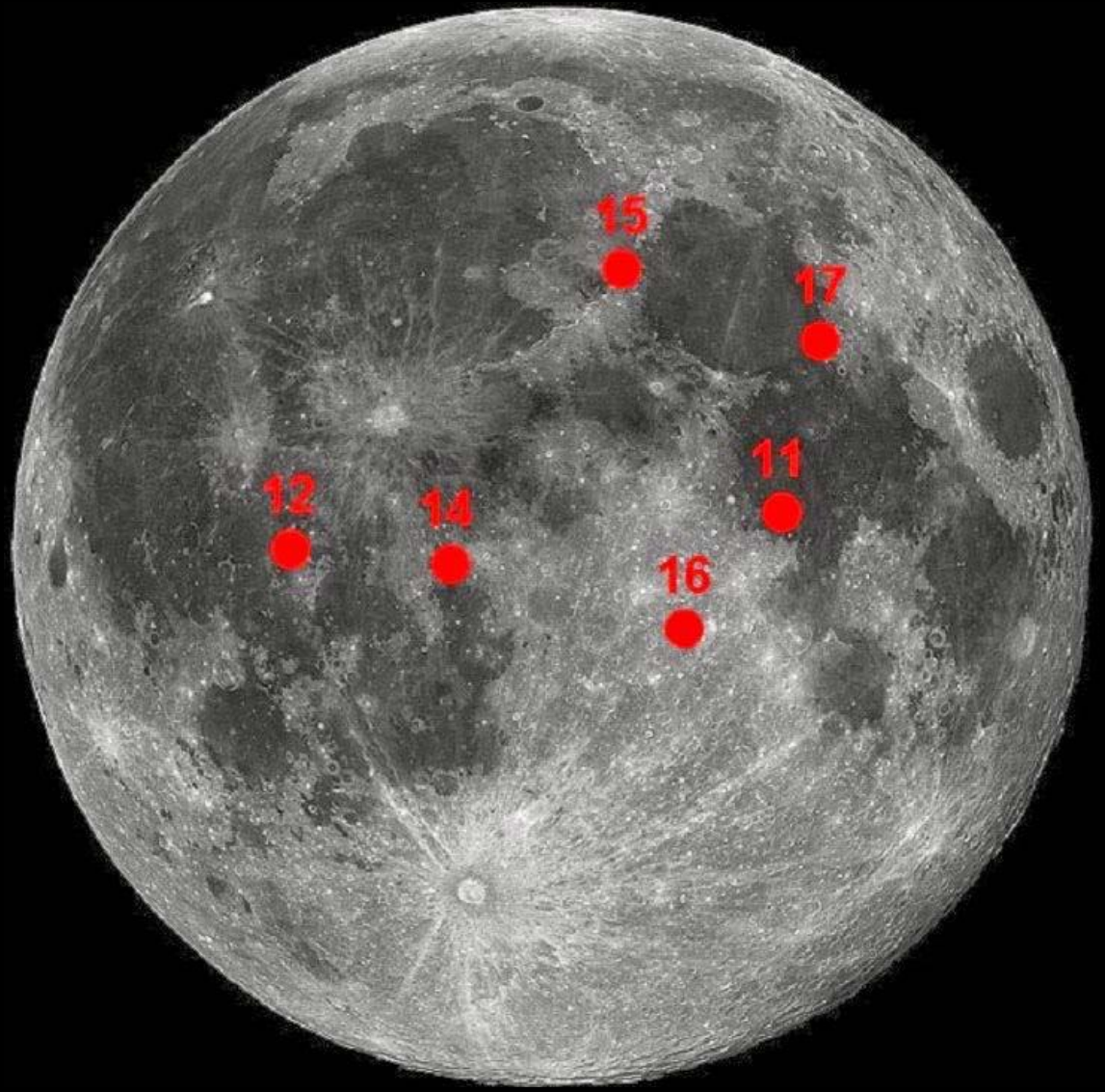
Apollo 11



Neil Armstrong Michael Collins Edwin “Buzz” Aldrin

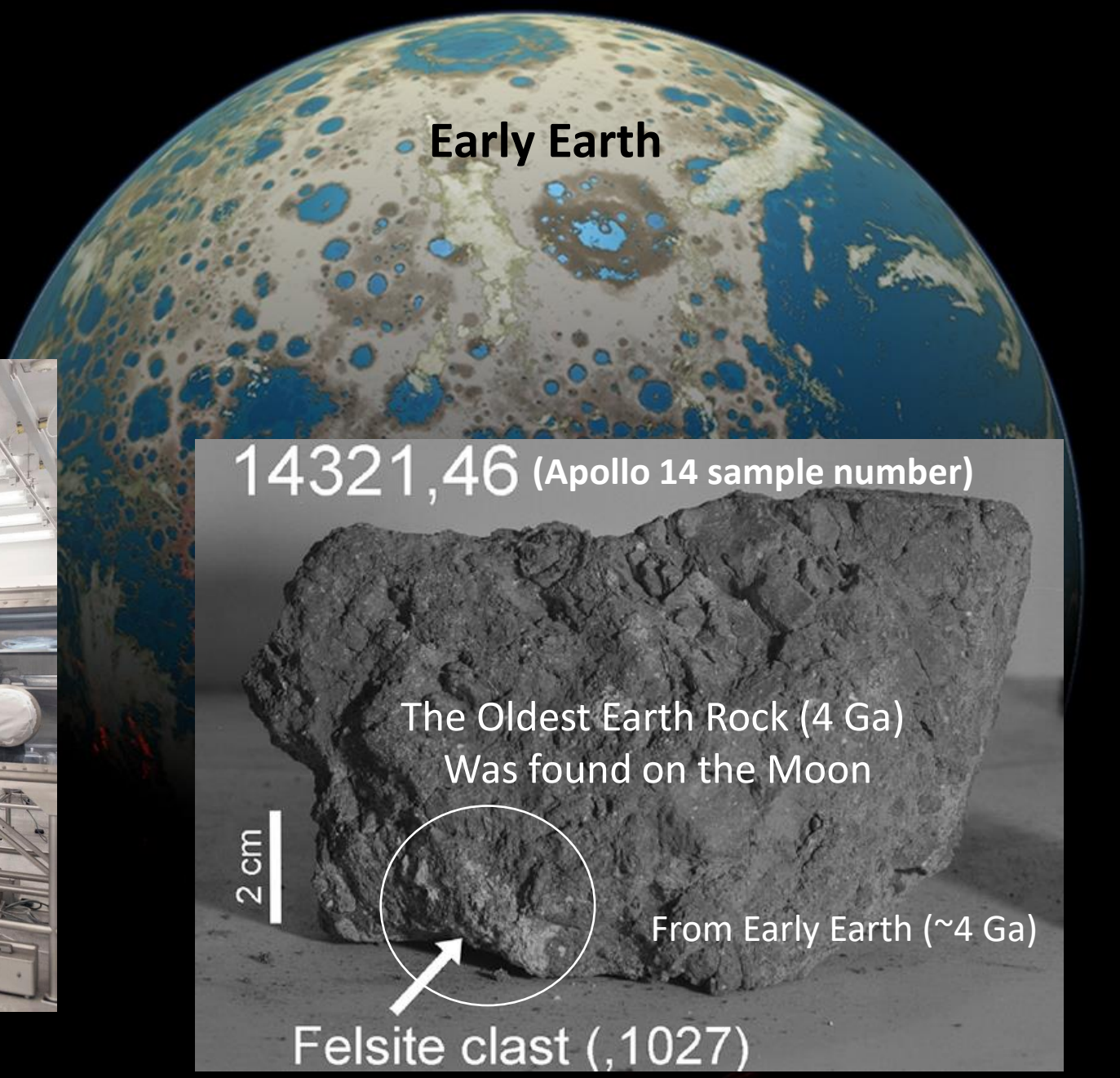


Apollo Lunar Exploration Program

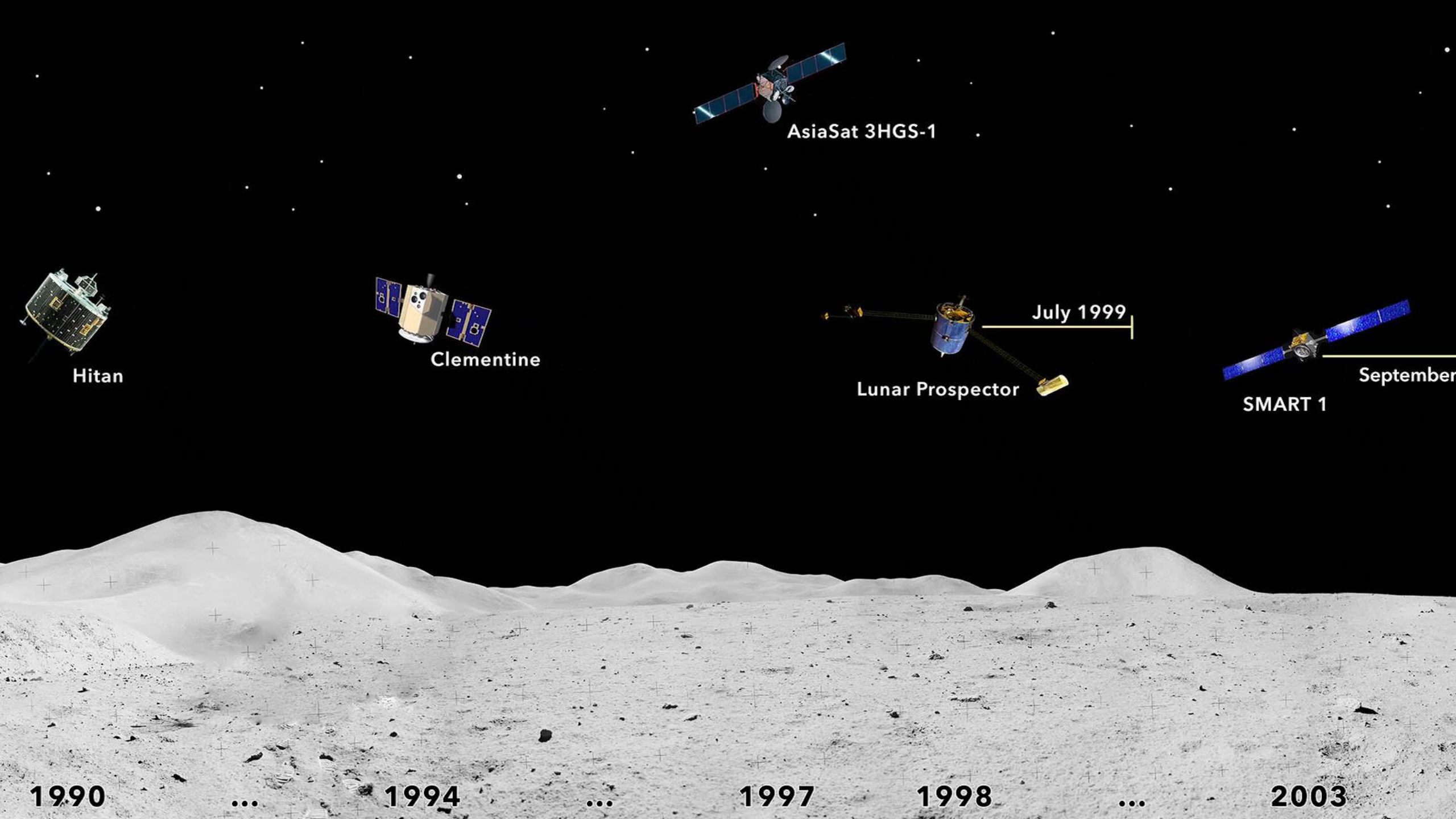


Apollo 11 Landing Site

Apollo Lunar Materials Keep in Curation Facility

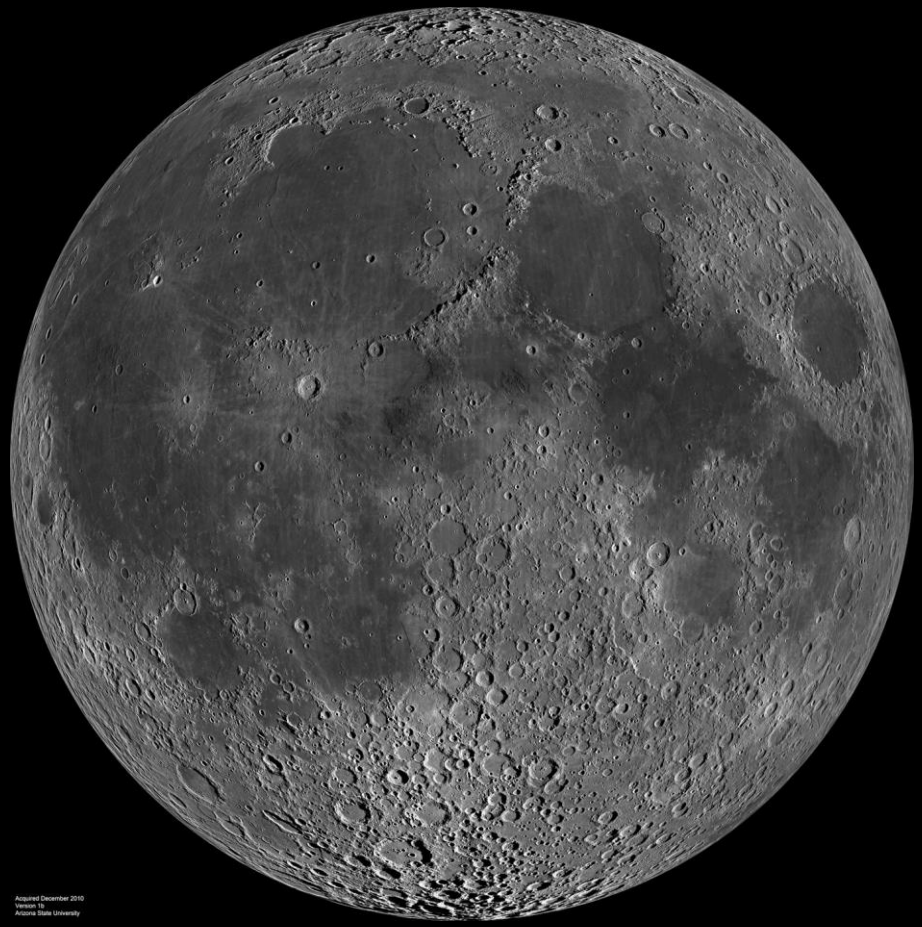


Belucci, et.al. 2019

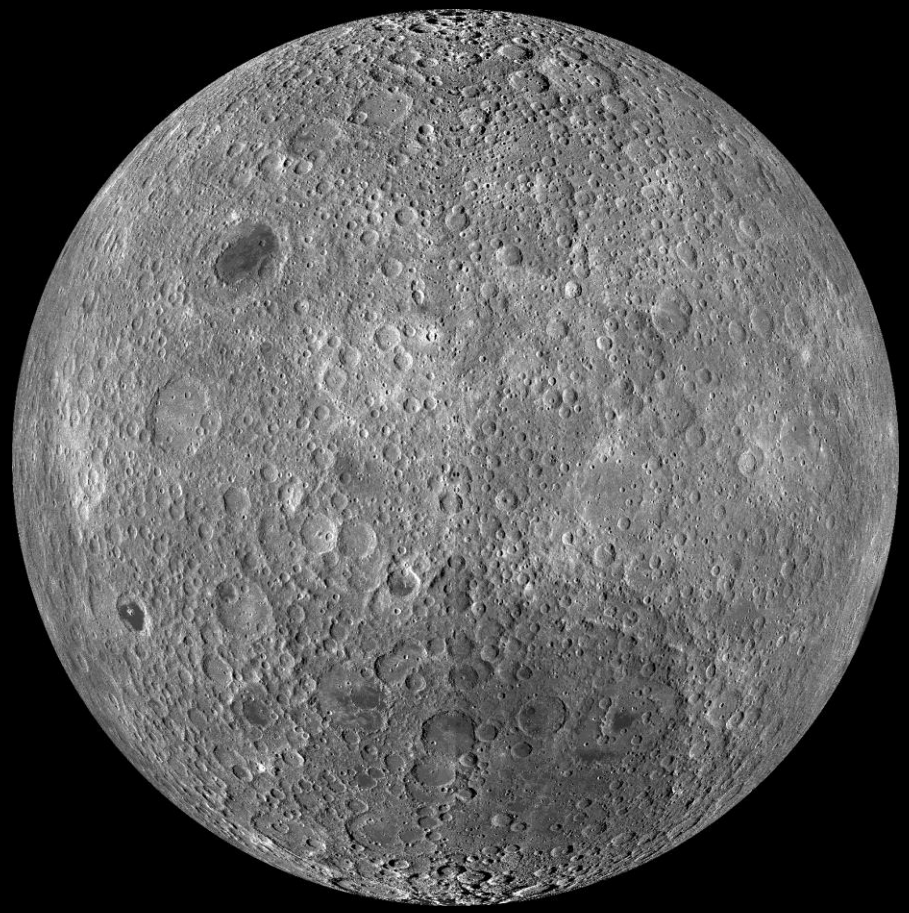

AsiaSat 3HGS-1
Hitan
Clementine
July 1999
Lunar Prospector
SMART 1
September
1990
...
1994
...
1997
1998
...
2003

Earth's Moon

Nearside



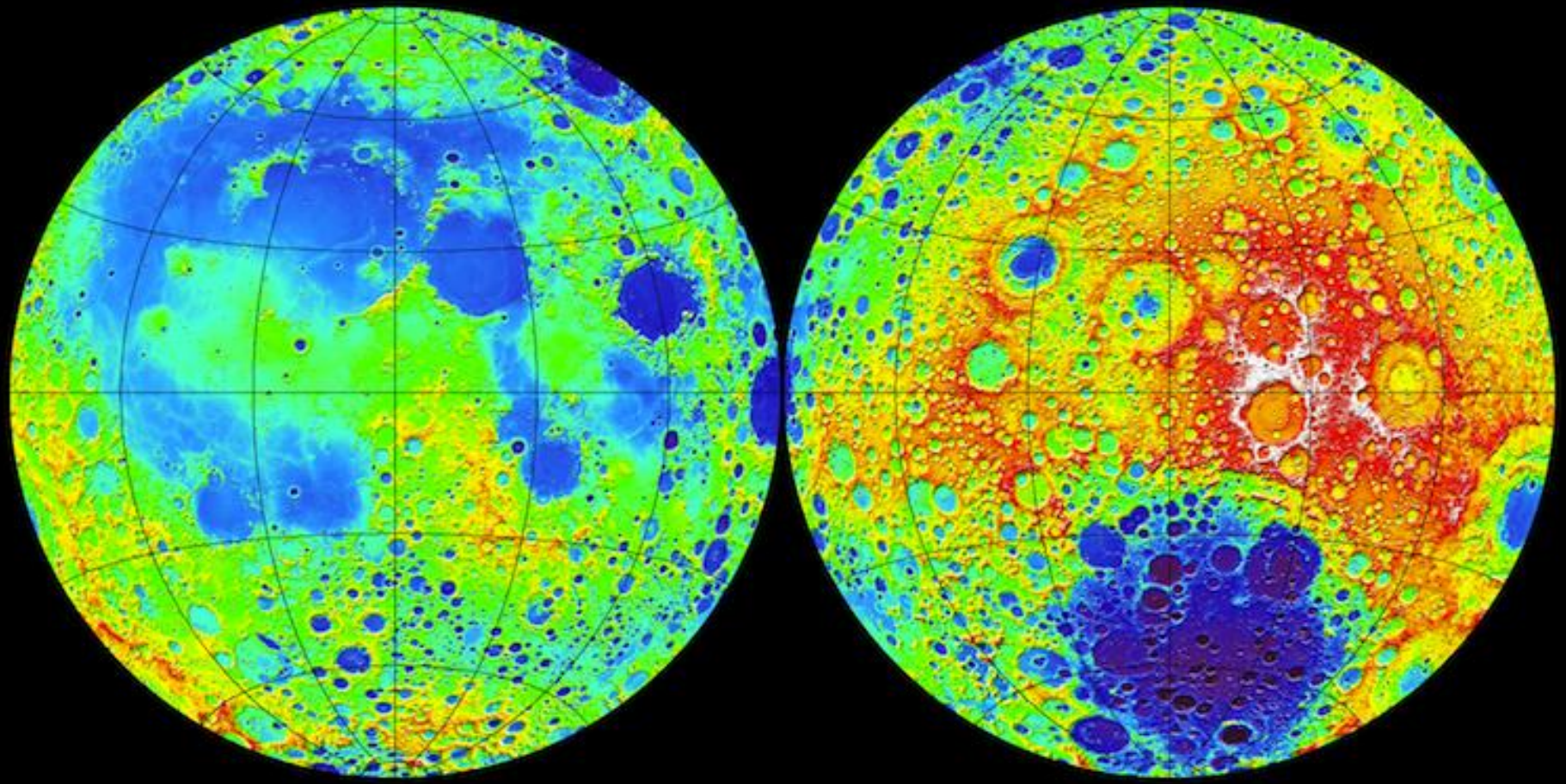
Farside

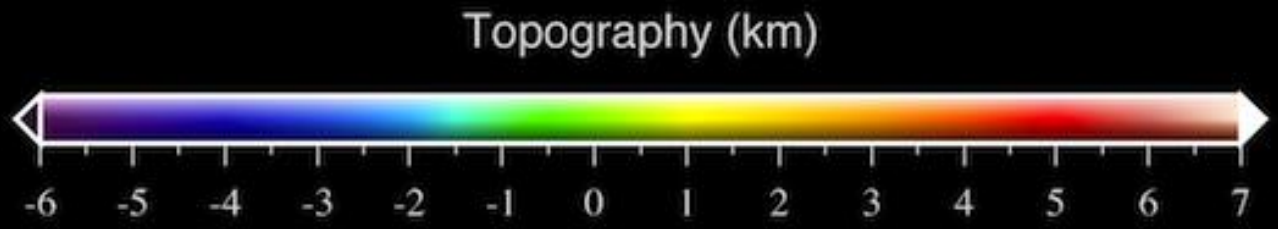


Earth's Moon
Altitude

Nearside

Farside

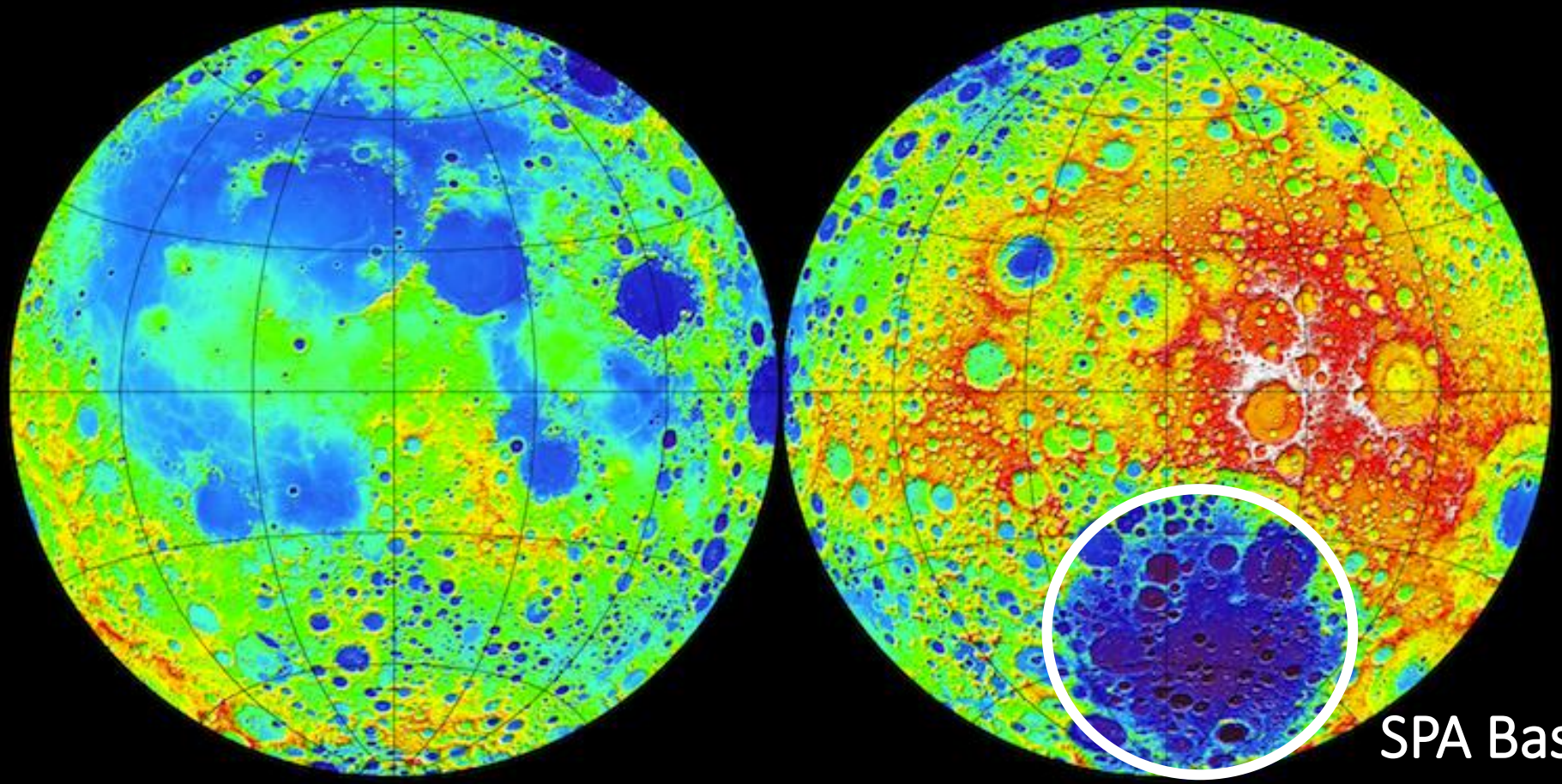




Earth's Moon
Altitude

Nearside

Farside

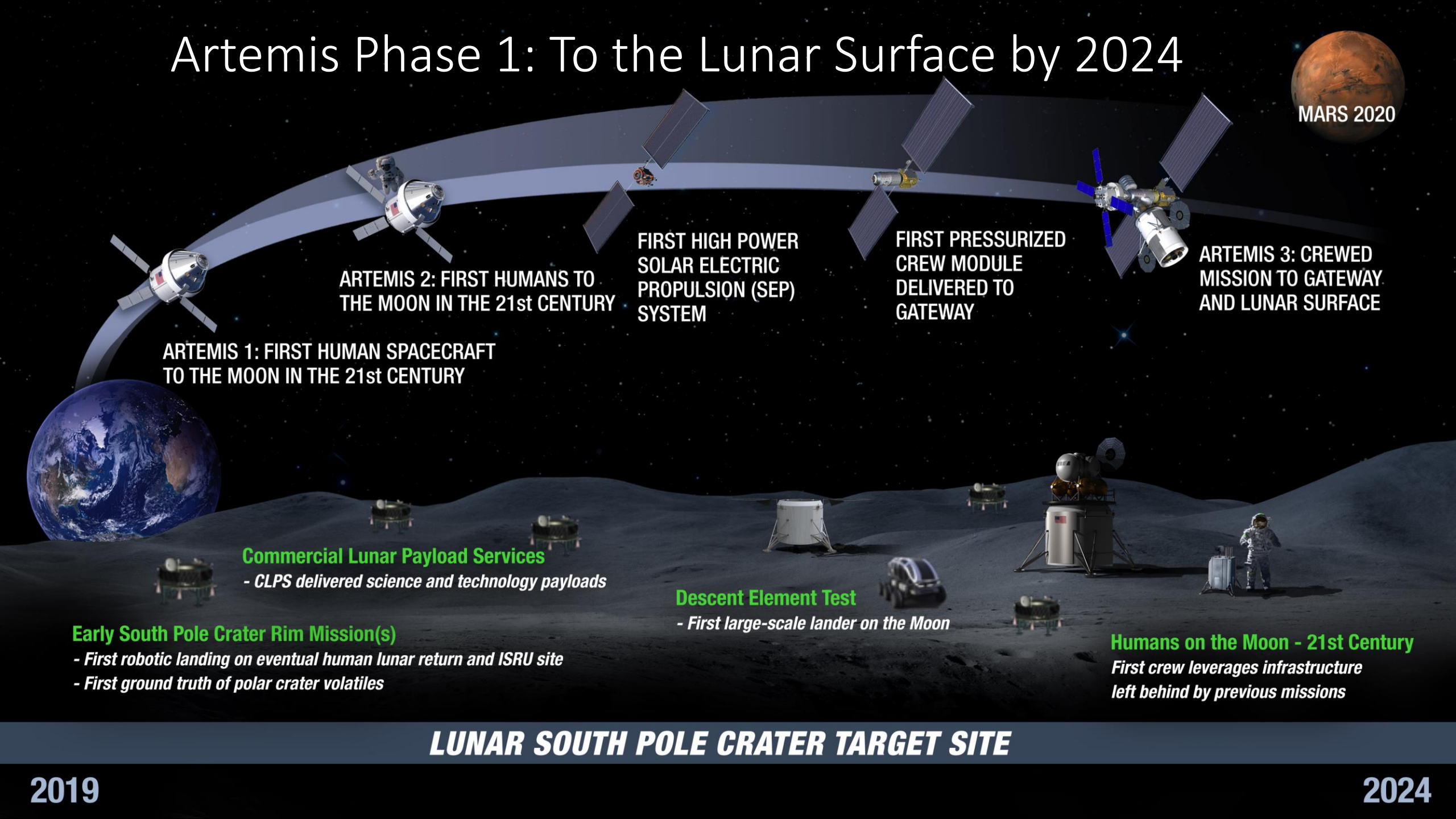


SPA Basin

Topography (km)

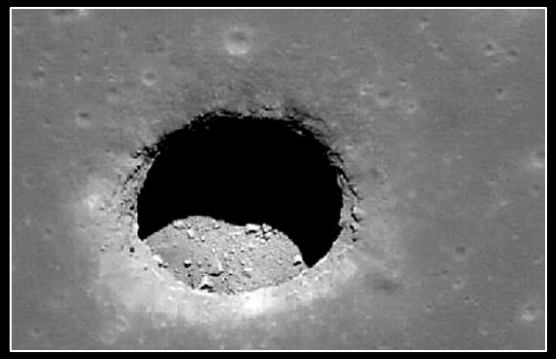
-6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7

Artemis Phase 1: To the Lunar Surface by 2024



Future Moon

Science & Exploration



Living off the Land

Multi-planet Species

Fuel Depot

Mining

Manufacturing

What is Moon Trek?

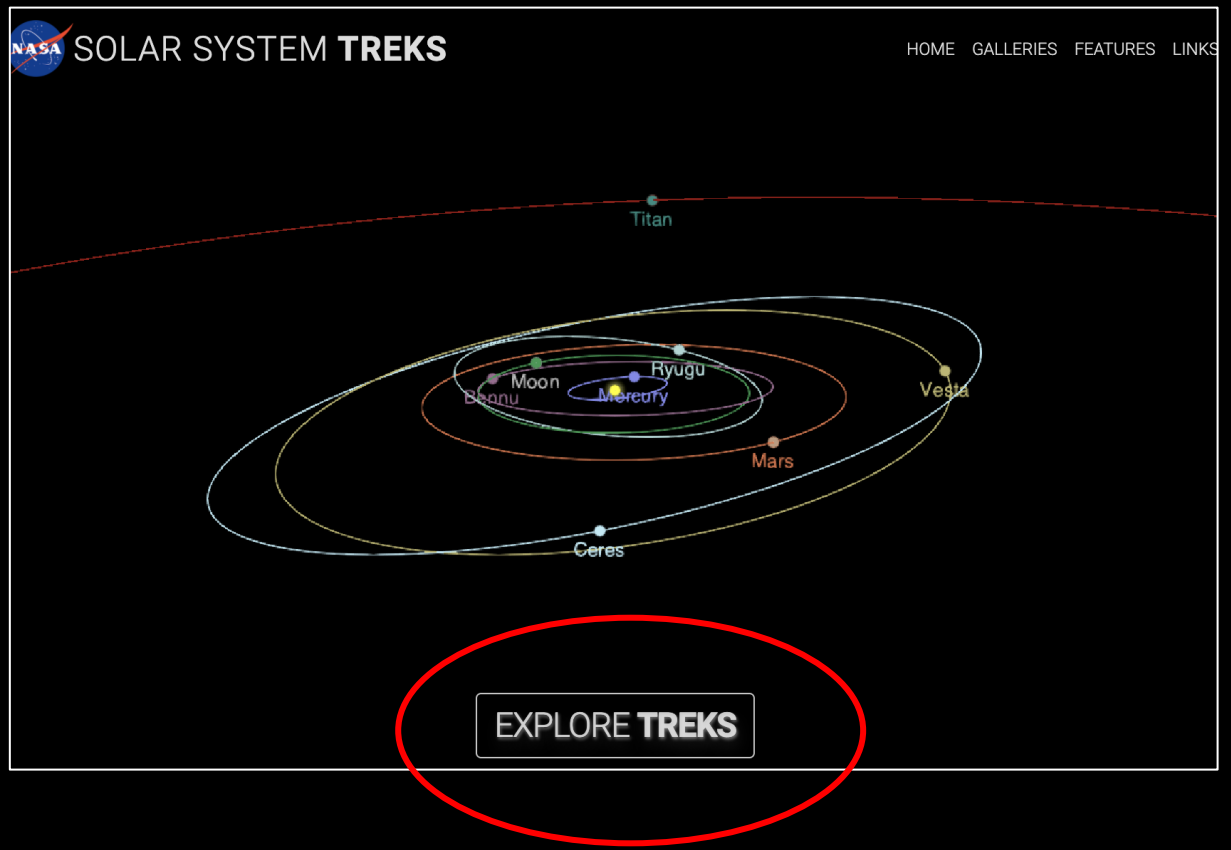
https://trek.nasa.gov/moon

Solar System Treks (SST)

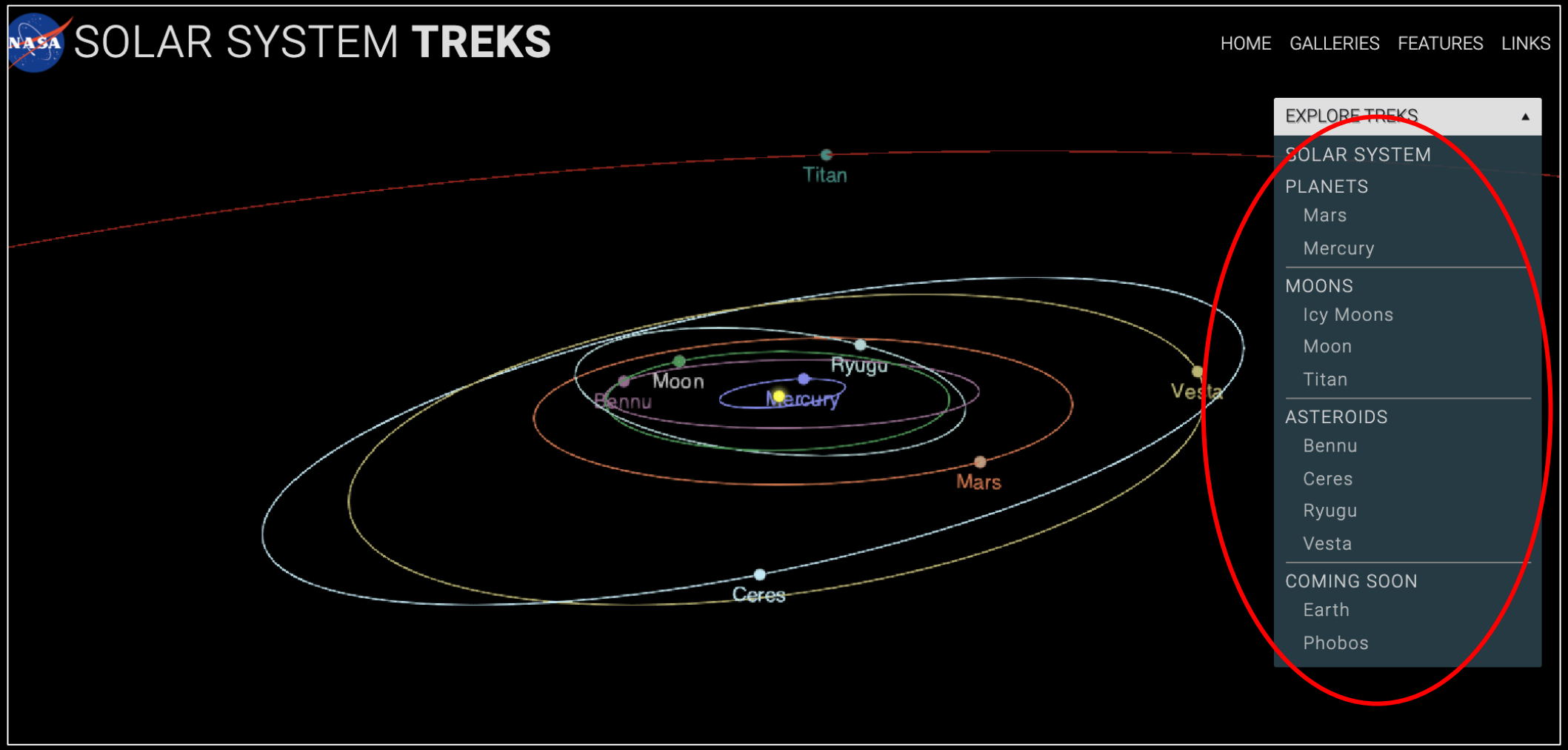
https://trek.nasa.gov

Web based interactive GIS portals

- Planetary surface Visualization
- Planetary Data Analysis
- Diverse User Base in Support of
  - Mission Planning
  - Scientific Research
  - Public Outreach/STEM



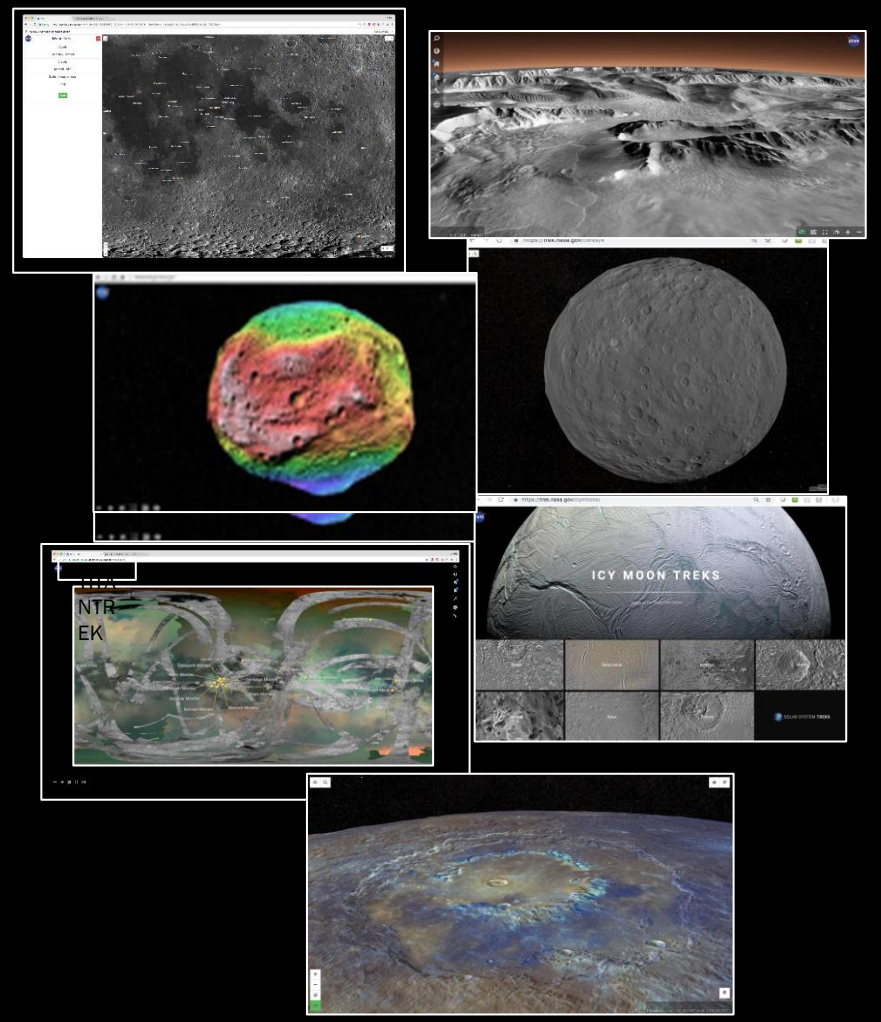
Other Worlds to Explore

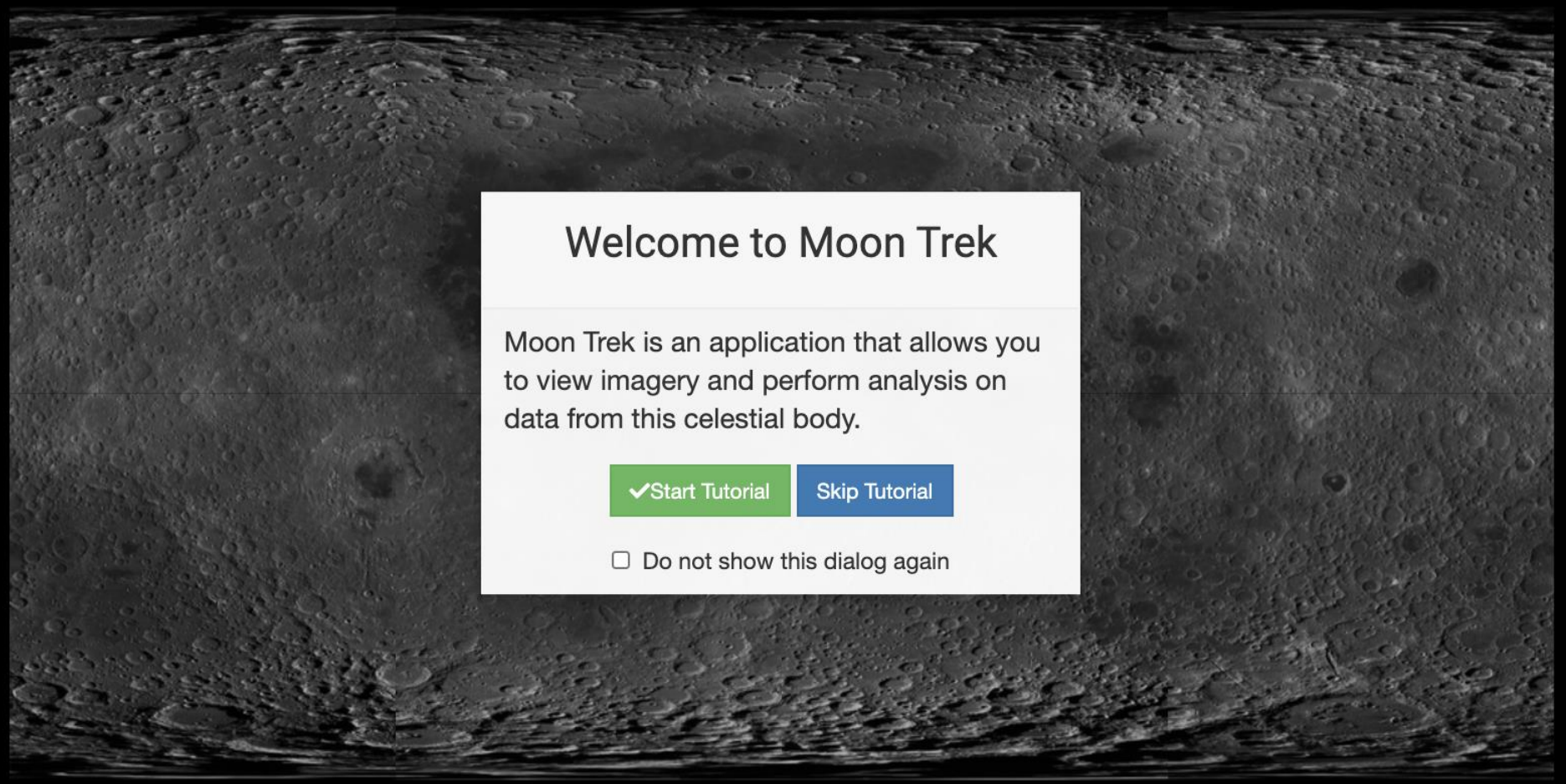


Trek Portals

Publicly Available

- Moon Trek – https://trek.nasa.gov/moon
- Mars Trek – https://trek.nasa.gov/mars
- Vesta Trek – https://trek.nasa.gov/vesta
- Ceres Trek - https://trek.nasa.gov/ceres
- Titan Trek – https://trek.nasa.gov/titan
- IcyMoons Trek – https://trek.nasa.gov/icymoons
- Mercury Trek – https://trek.nasa.gov/mercury
- Bennu Trek – https://trek.nasa.gov/bennu
- Ryugu Trek – https://trek.nasa.gov/ryugu





Welcome to Moon Trek

Moon Trek is an application that allows you to view imagery and perform analysis on data from this celestial body.

✔Start Tutorial | Skip Tutorial

☐ Do not show this dialog again

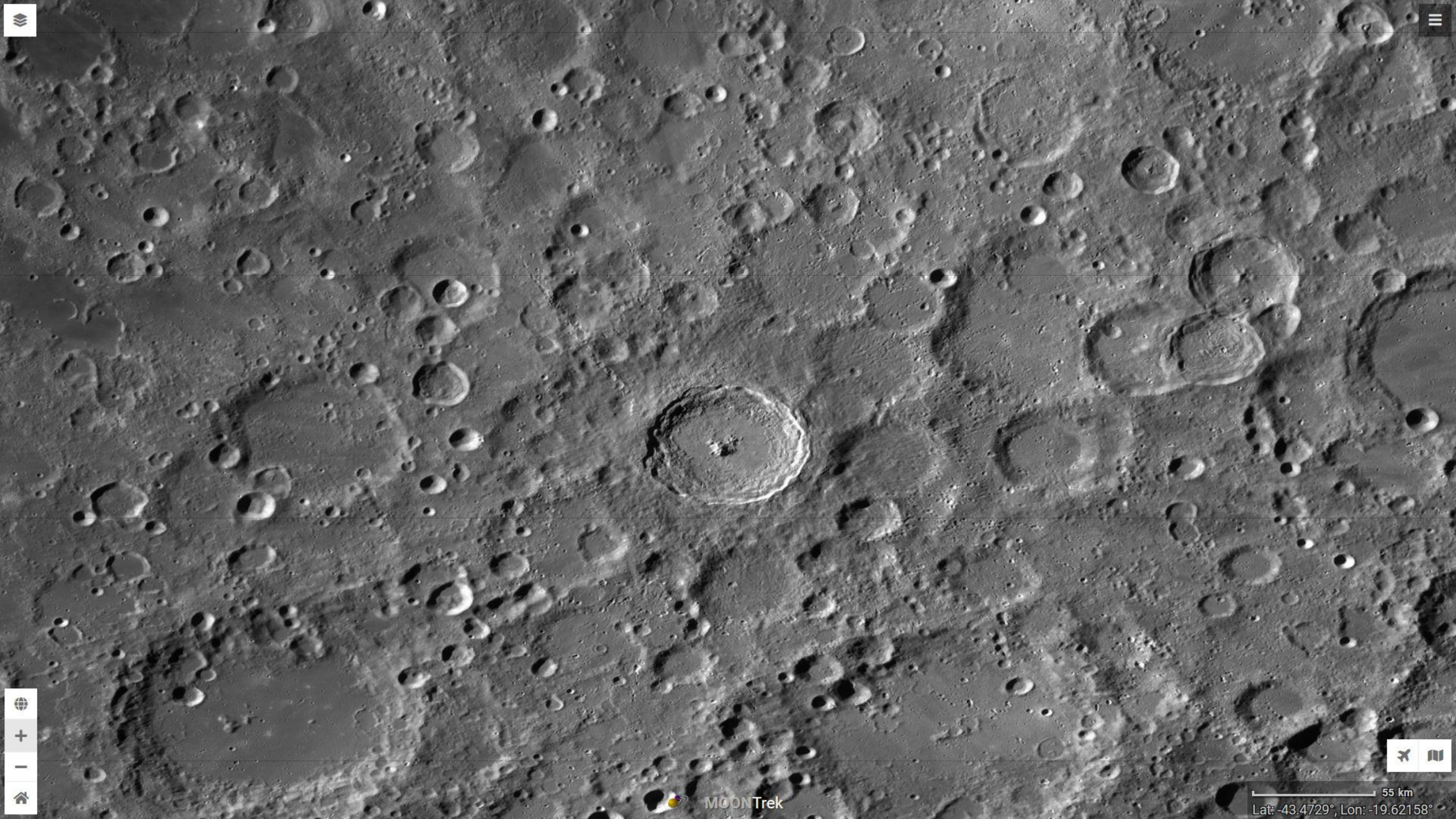
MOONTrek

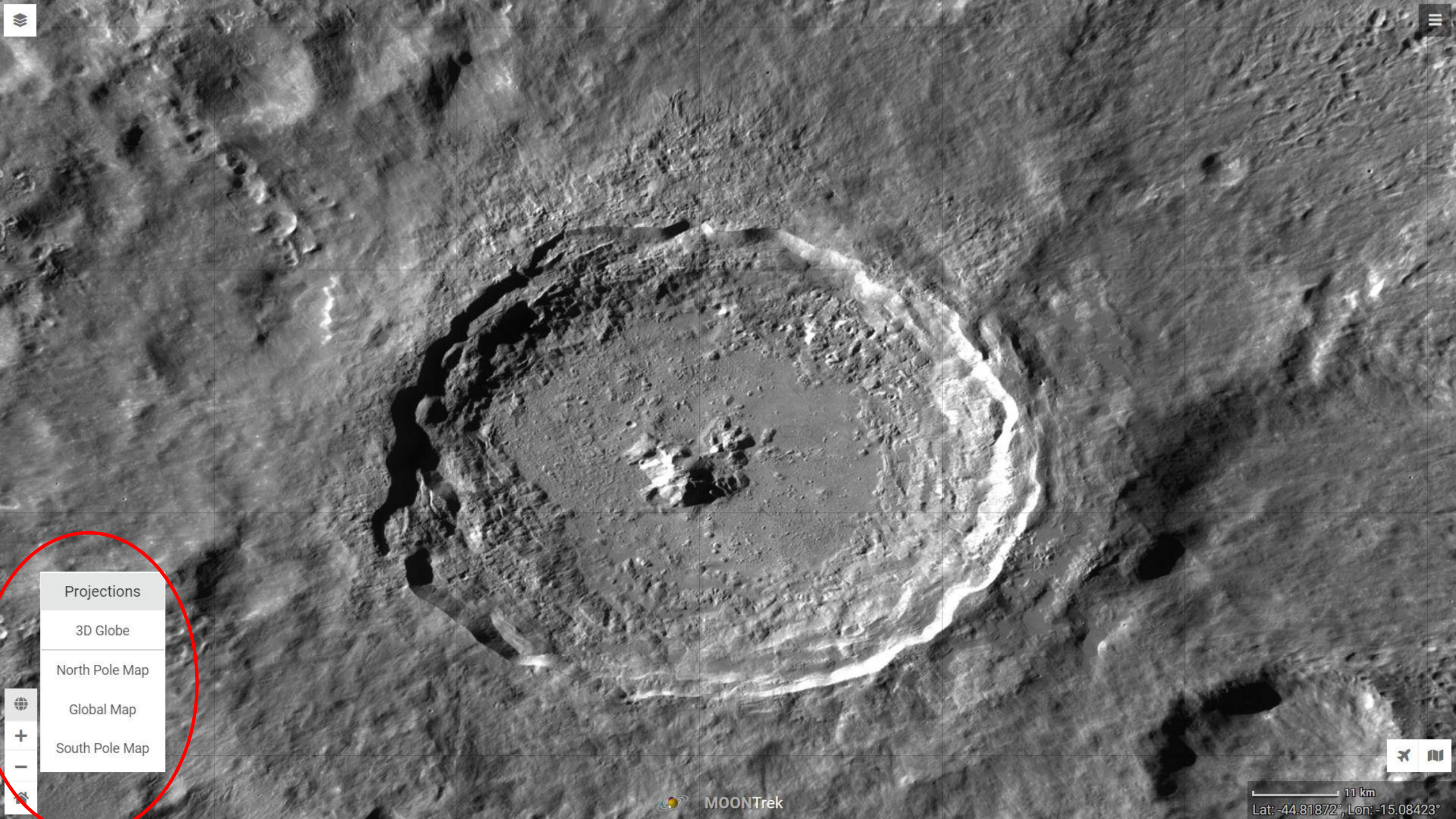
550 km

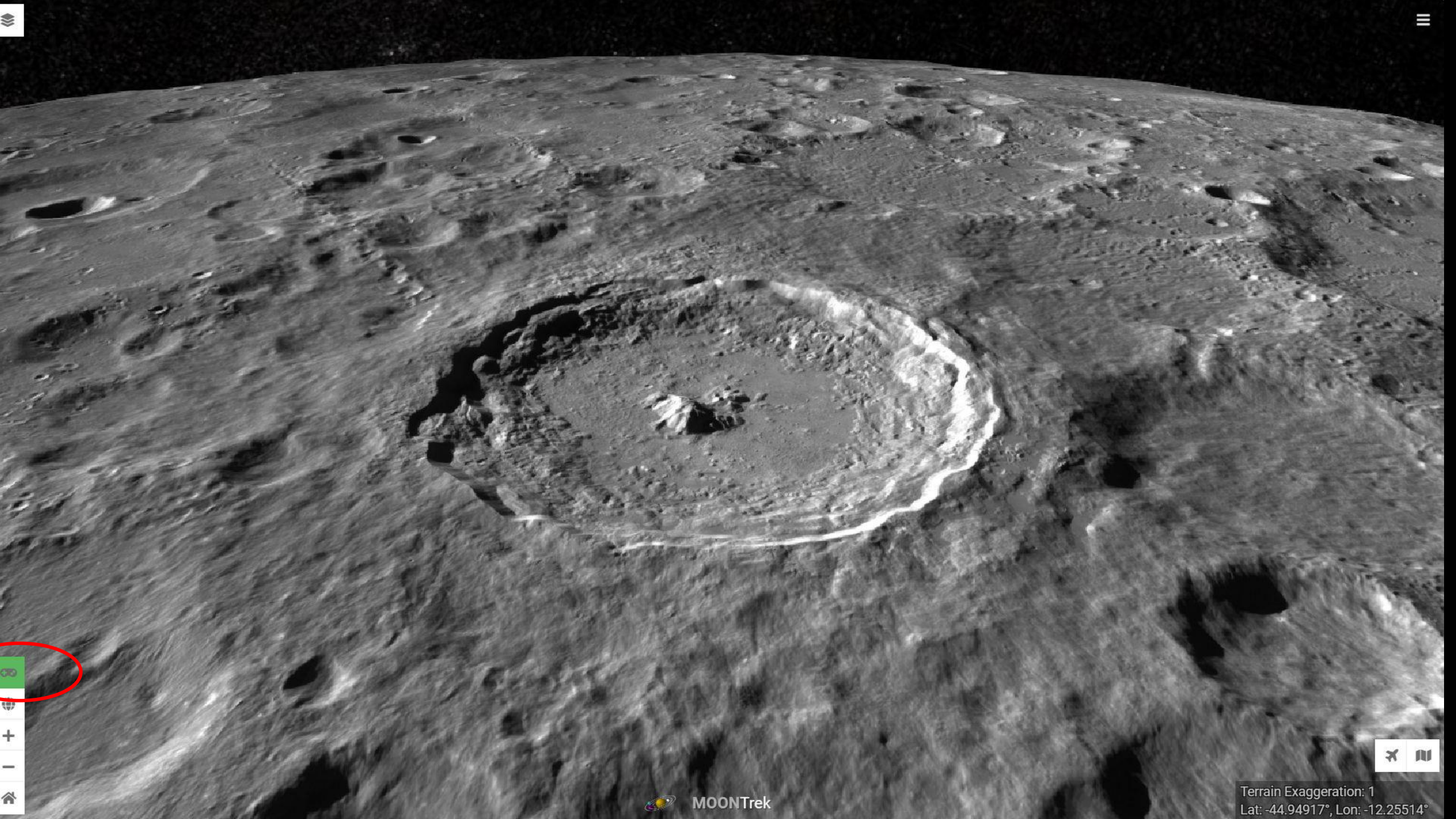
Lat: -°. Lon: -°

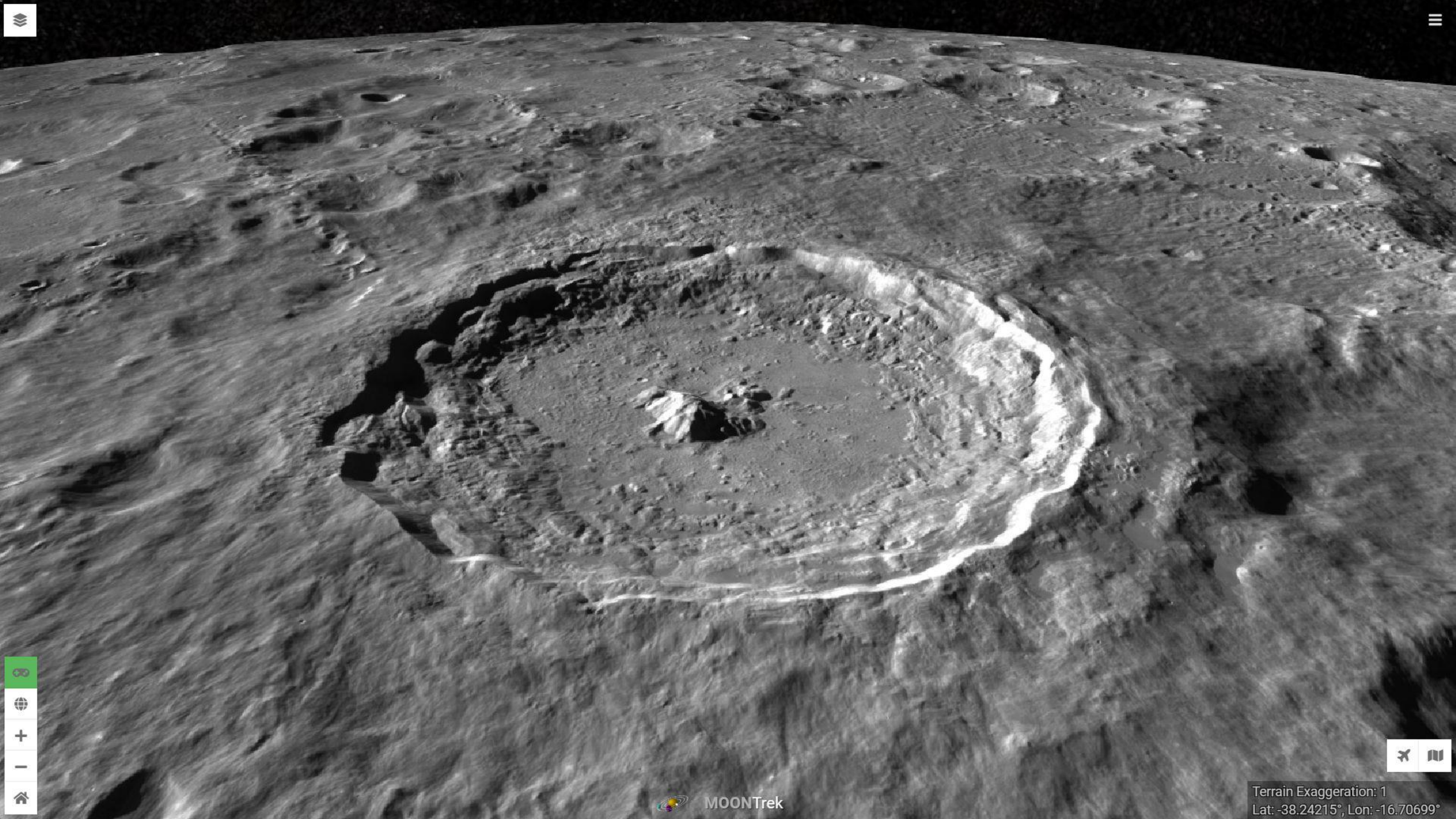

MOONTrek
55 km
Lat: -22.97241°, Lon: -16.08398°

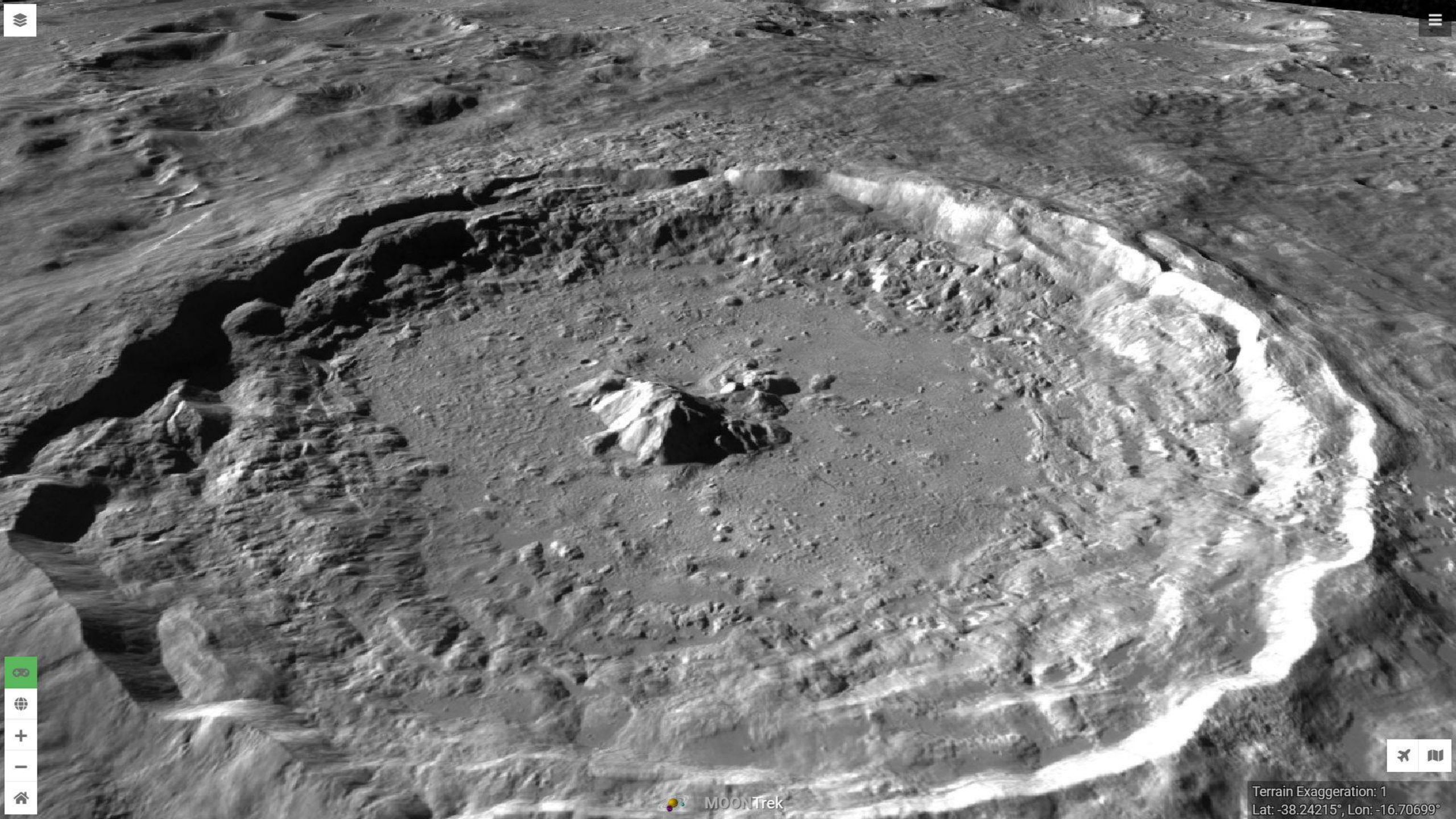

MOONTrek
110 km
Lat: -47.8894°, Lon: -37.5293°


MOONTrek
55 km
Lat: -43.4729°, Lon: -19.62158°


Projections
3D Globe
North Pole Map
Global Map
South Pole Map
MOONTrek
11 km
Lat: -44.81872°, Lon: -15.08423°

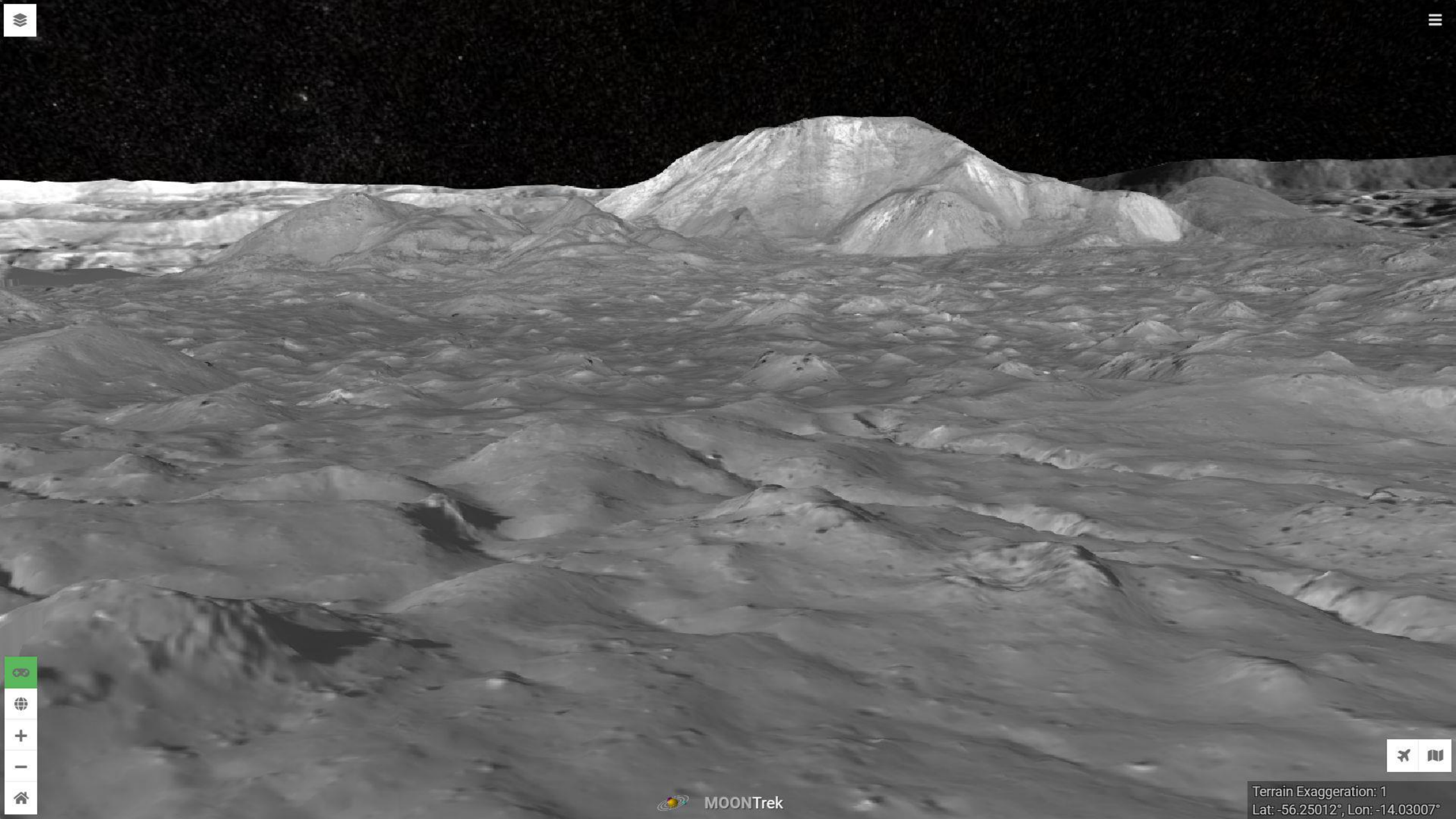

MOONTrek
Terrain Exaggeration: 1
Lat: -44.94917°, Lon: -12.25514°


MOONTrek
Terrain Exaggeration: 1
Lat: -38.24215°, Lon: -16.70699°

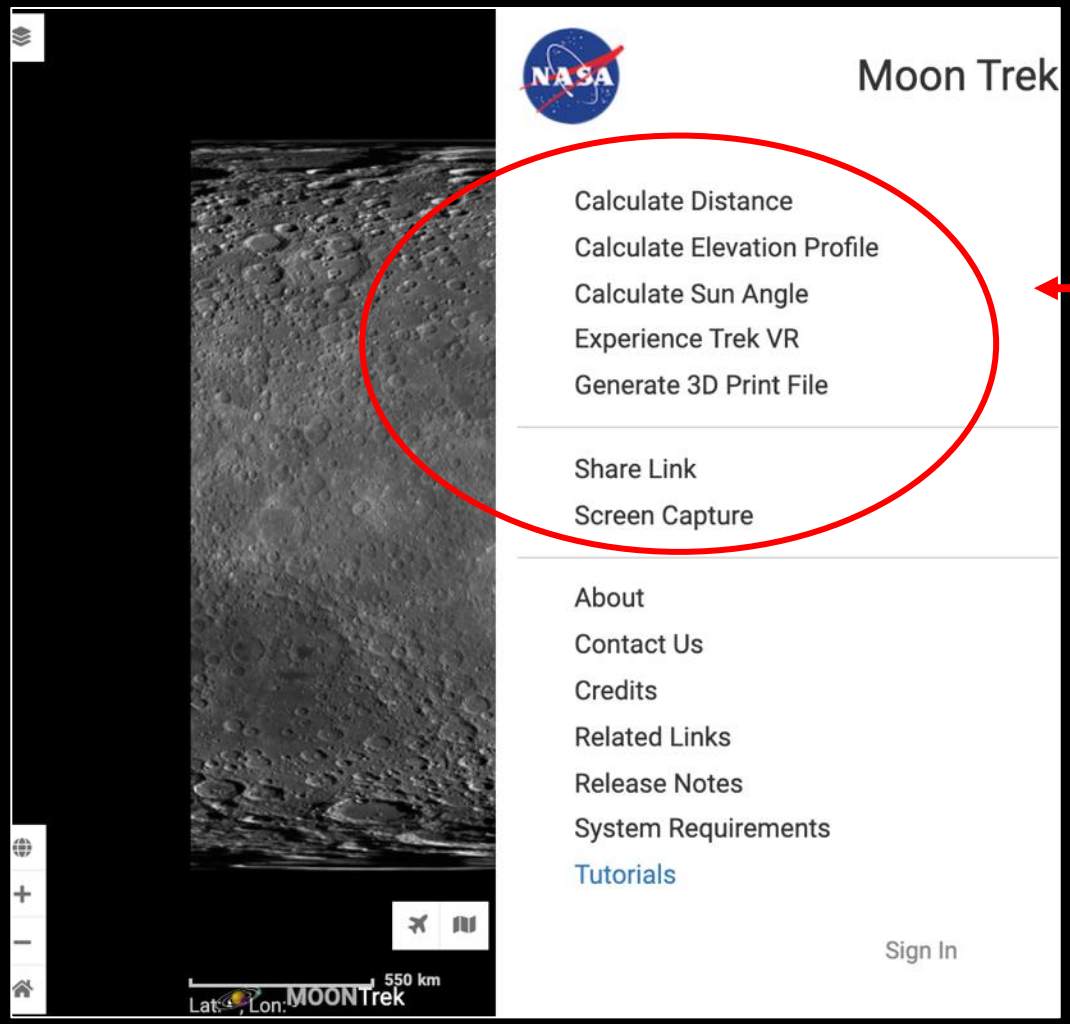

MOONTrek
Terrain Exaggeration: 1
Lat: -38.24215°, Lon: -16.70699°


MOONTrek
Terrain Exaggeration: 1
Lat: -38.24215°, Lon: -16.70699°


MOONTrek
Terrain Exaggeration: 1
Lat: -42.89227°, Lon: -11.49915°

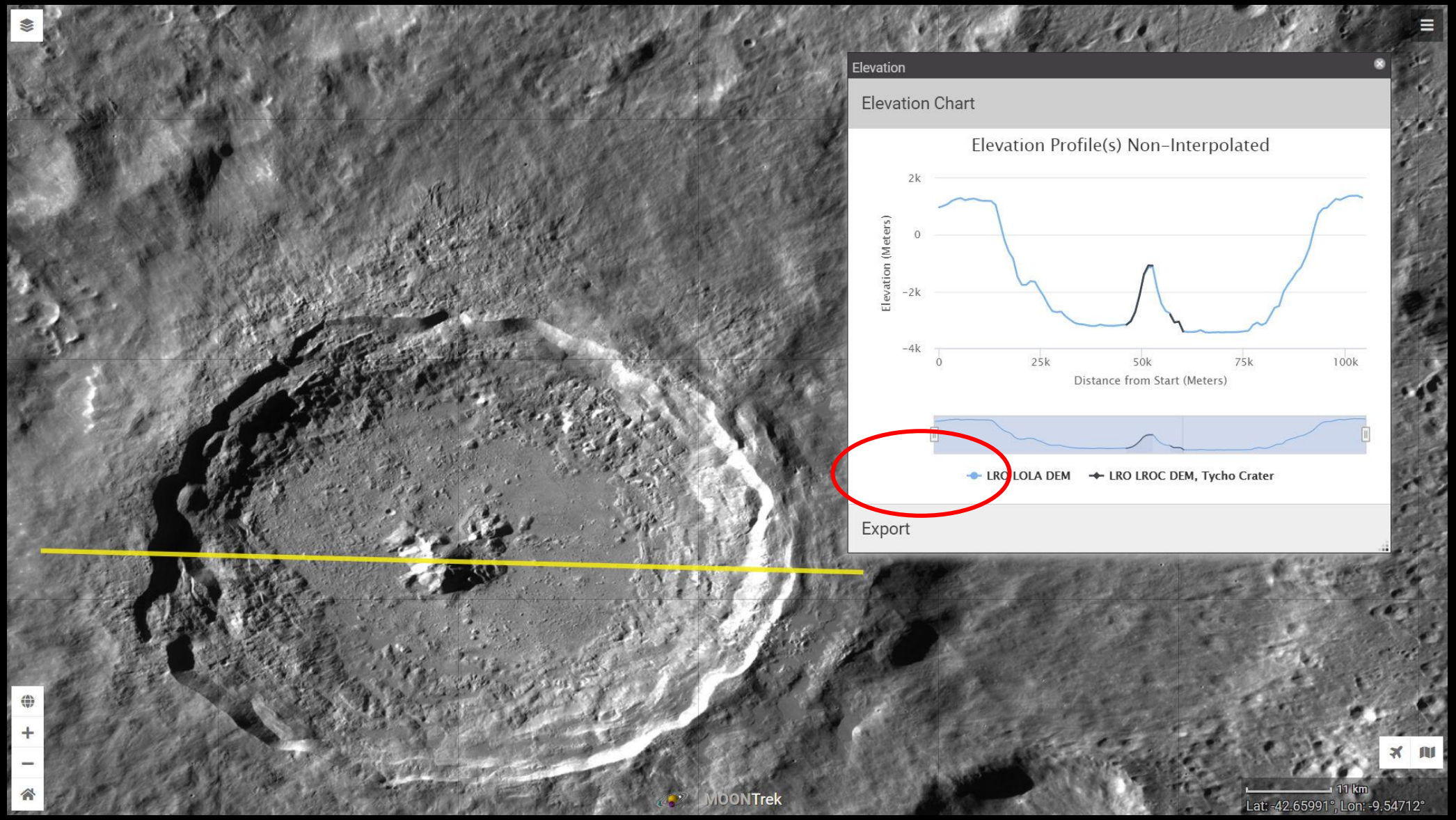

MOONTrek
Terrain Exaggeration: 1
Lat: -56.25012°, Lon: -14.03007°

Tools

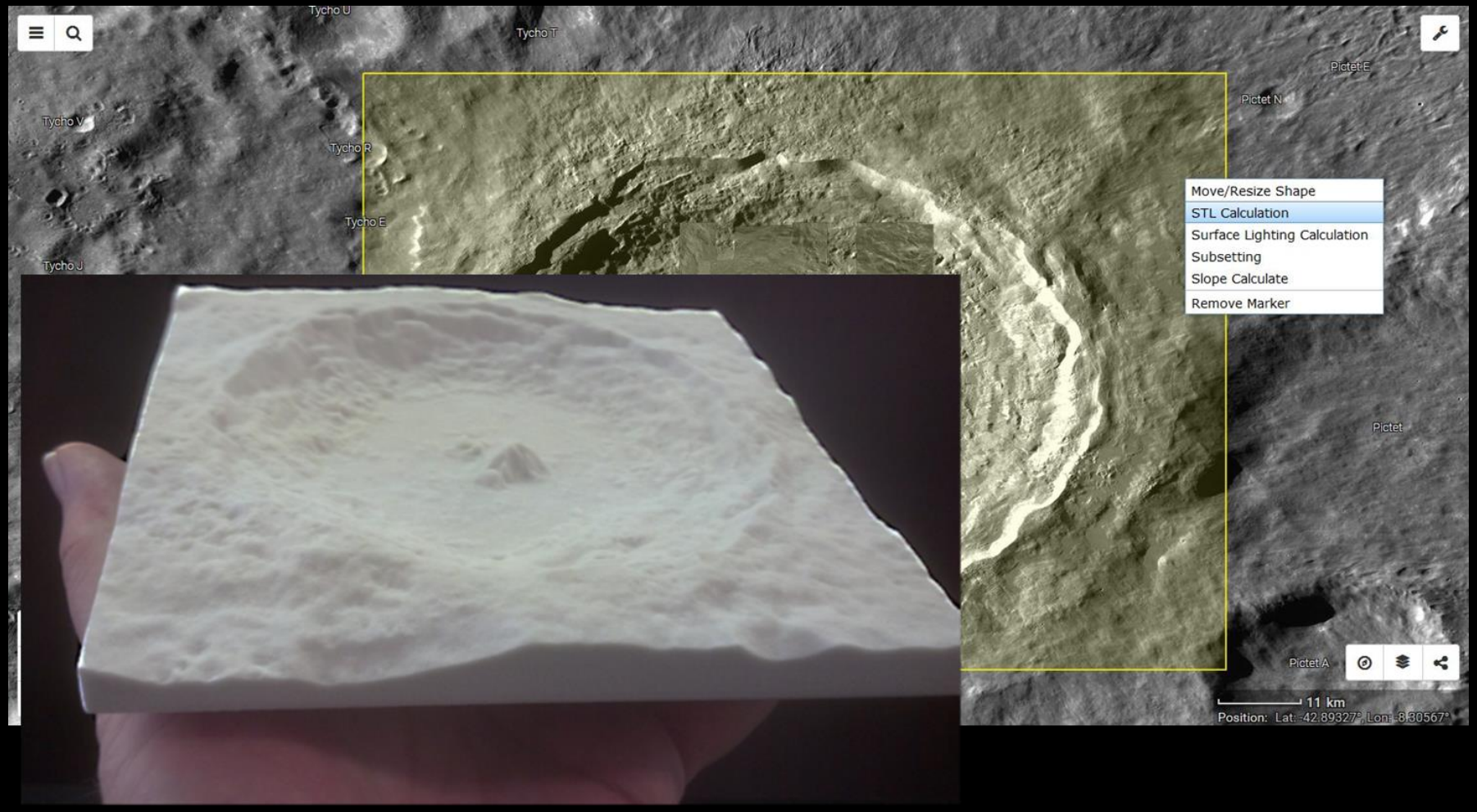


- Available without requiring login
- Visualization
- Measurement
- Sharing

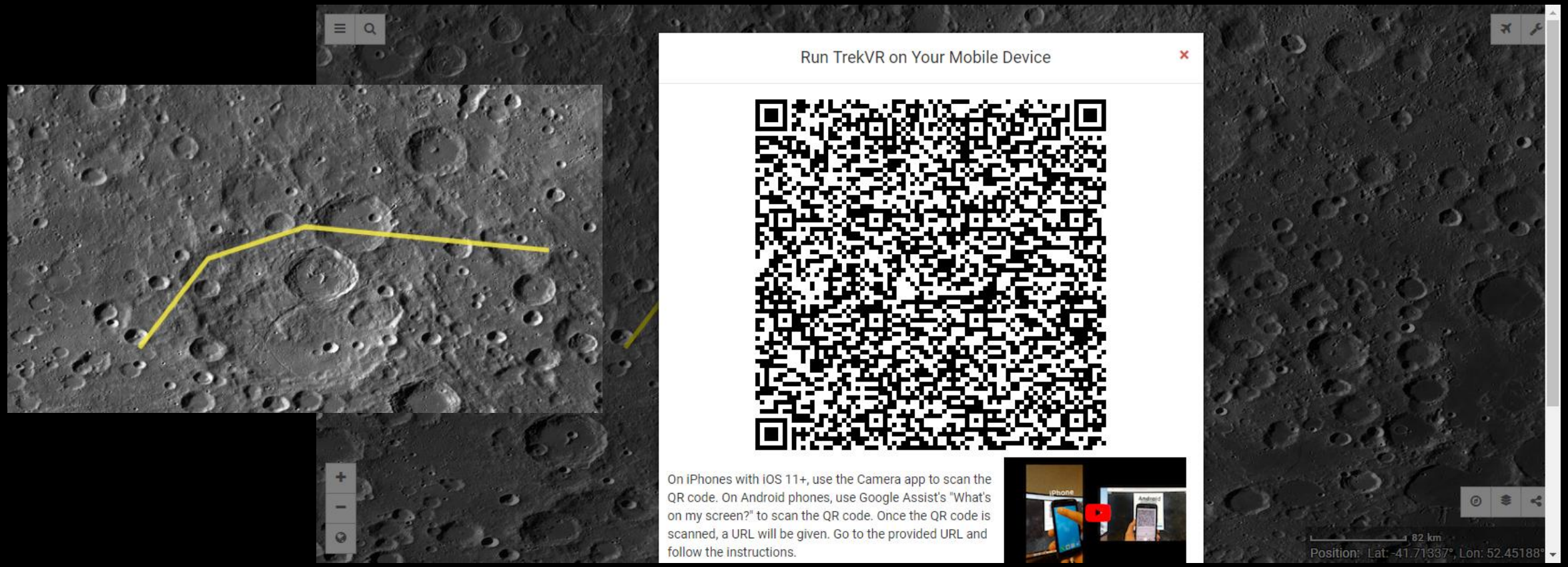
Calculate Elevation Profile



3D Print File Generation



Virtual Reality Experience

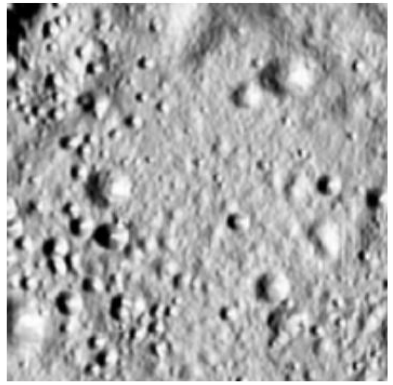


Marius Hills Shown in BaseMap

Staking layers @ Marius Hills

LOLA and TC Stereo DEM Merge 512ppd, Shade

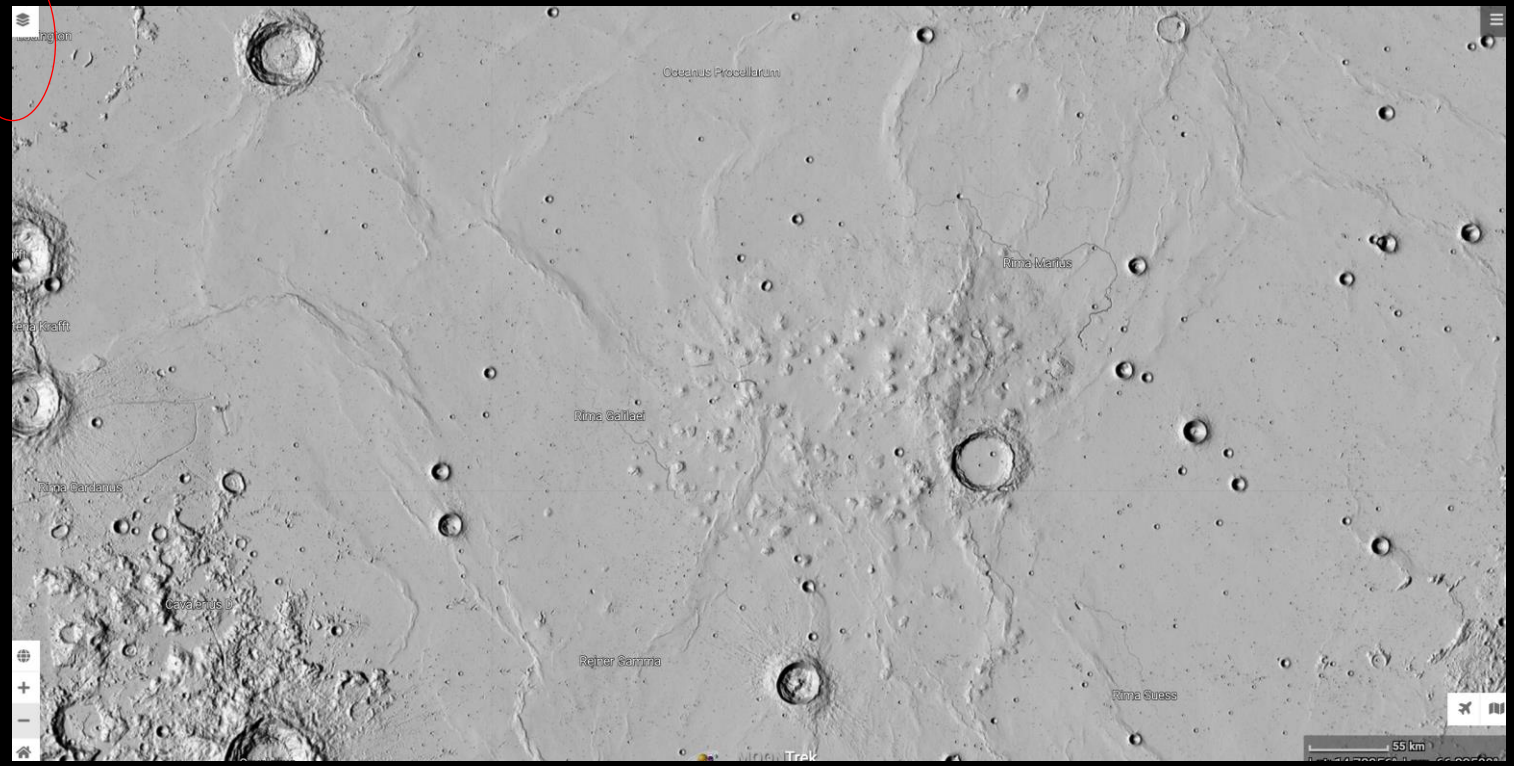
Item Type	product
Product Type	HillShade



This is a shaded-relief of the original LOLA and Kaguya Terrain Camera Stereo Merged Digital Elevation Model (DEM) released in early 2015. The DEM is a shape map of the Moon at a resolution of 512 pixels per degree (59m/pixels), based on altimetry data acquired by the LOLA instrument and Kaguya Terrain Camera Stereo data. Map values are referred to a radius of 1737400 m. SELENE is a Japanese mission developed and operated by JAXA. Please create NASA's LOLA Team and JAXA's SELENE/Kaguya Team.

Add | View Metadata | Download Metadata

Layers | Download | Fly To



Gravity of Marius Hills

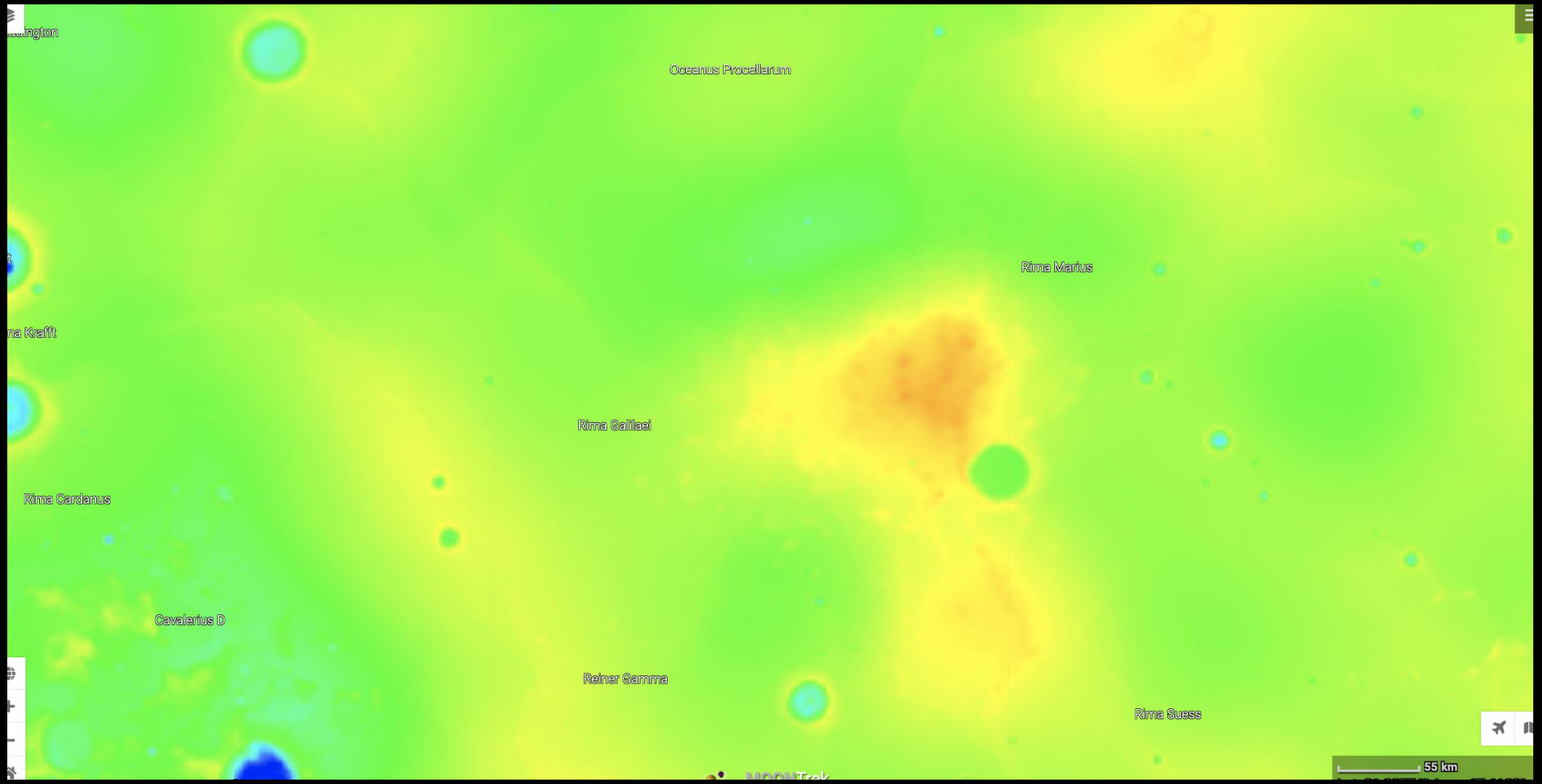
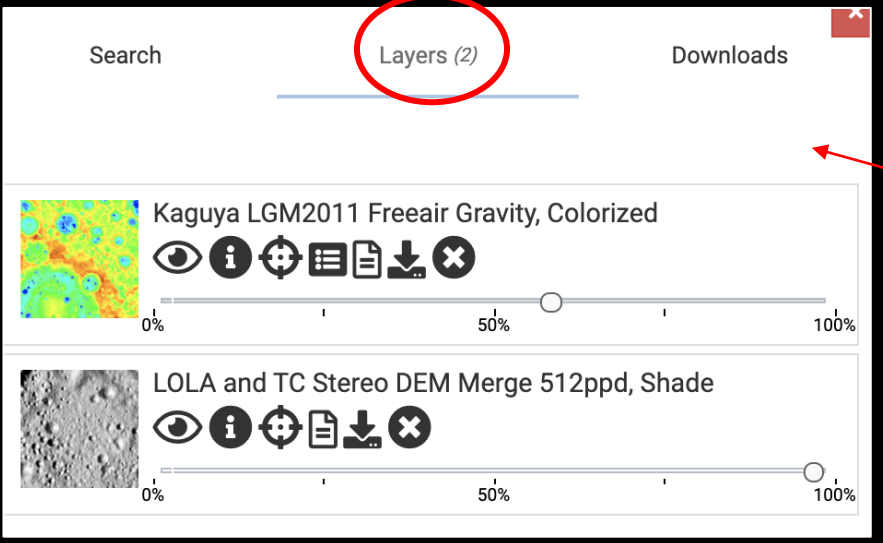
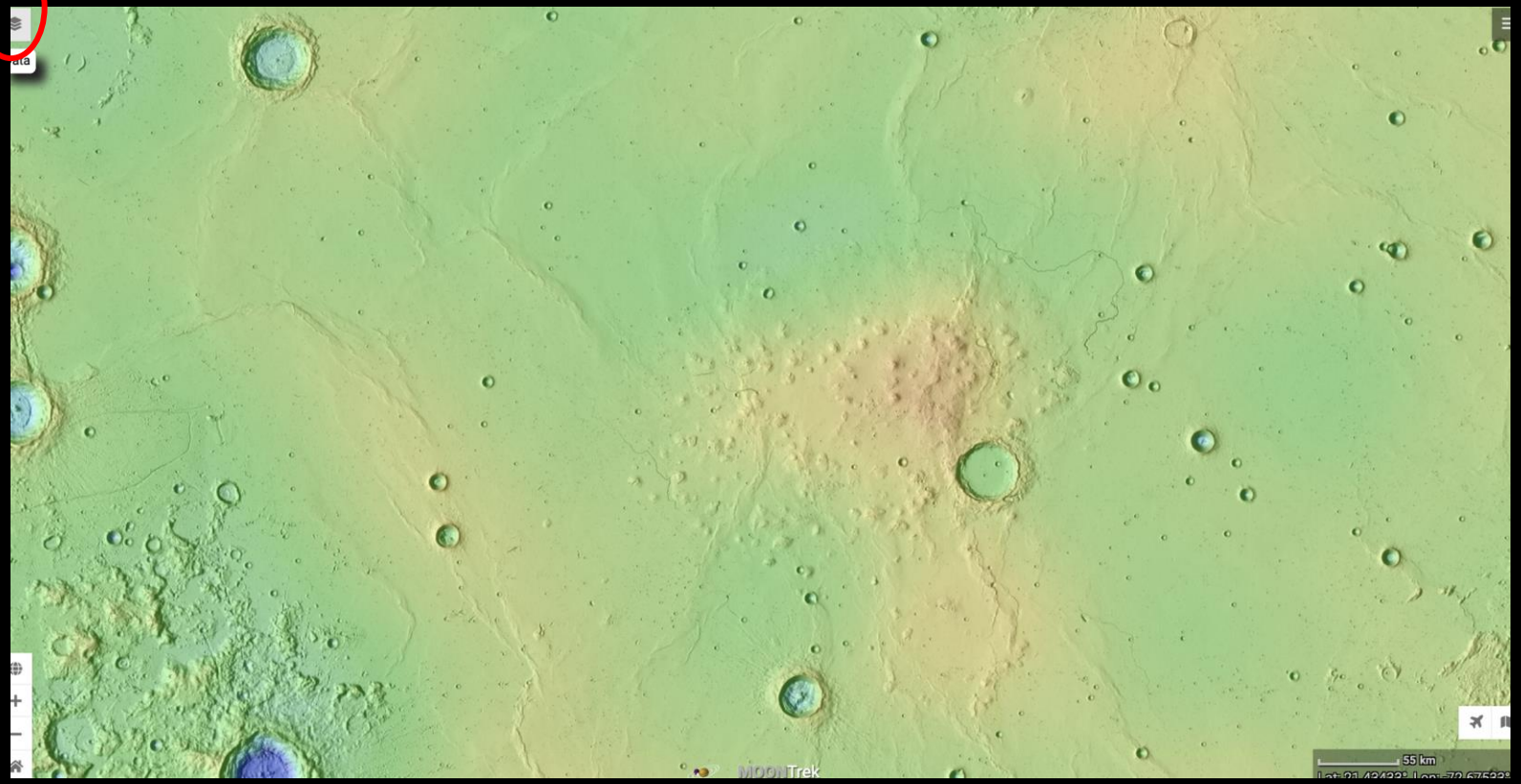
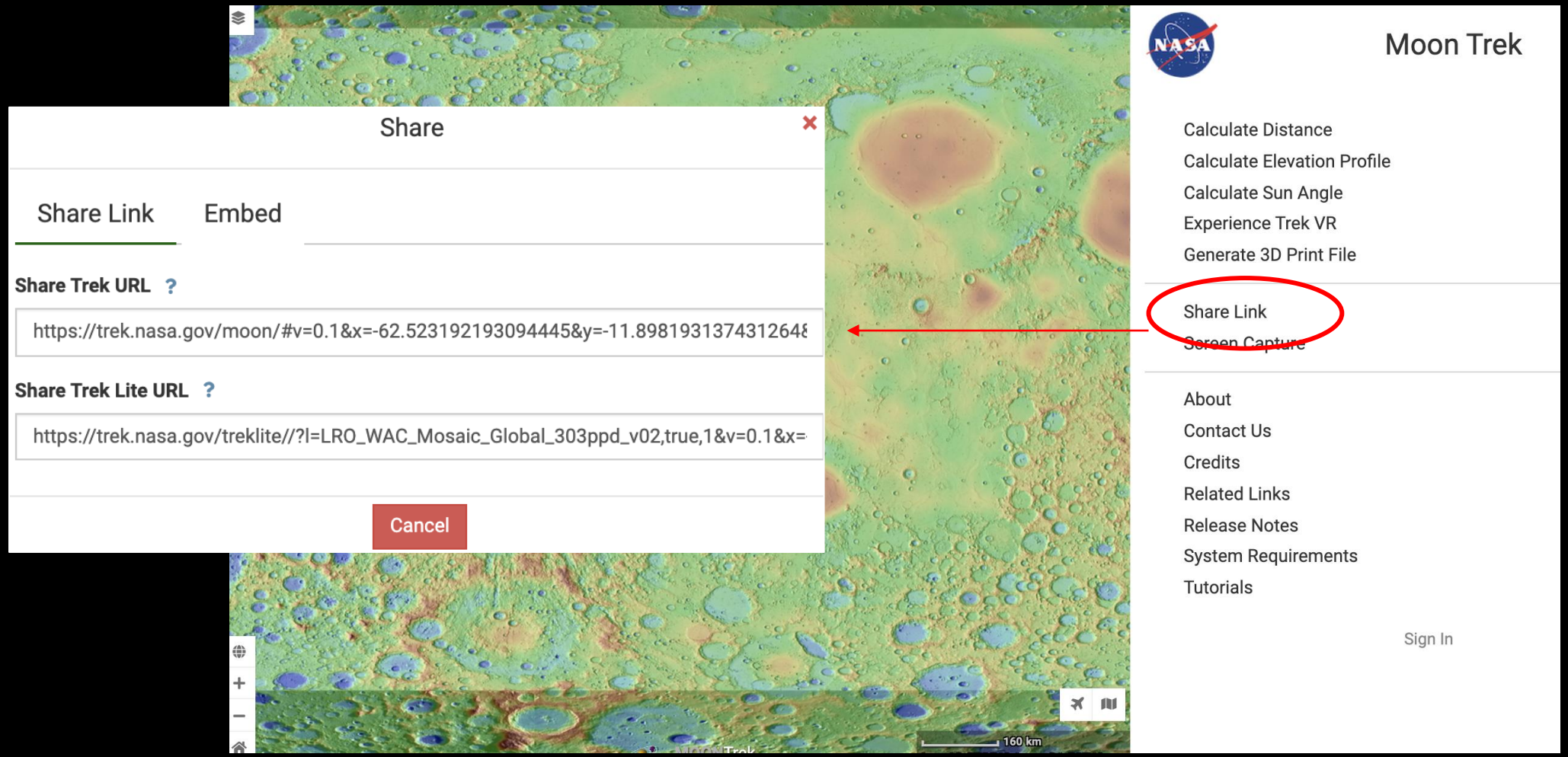


Image Integration / Blending





Sharing


Share
Share Link
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Share Trek URL
https://trek.nasa.gov/moon/#v=0.1&x=-62.523192193094445&y=-11.898193137431264
Share Trek Lite URL
https://trek.nasa.gov/treklite//?l=LRO_WAC_Mosaic_Global_303ppd_v02,true,1&v=0.1&x=
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Moon Trek
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Calculate Elevation Profile
Calculate Sun Angle
Experience Trek VR
Generate 3D Print File
Share Link
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Credits
Related Links
Release Notes
System Requirements
Tutorials
Sign In
160 km

Future City Competition

Design a future lunar city and provide examples of how your city uses two Moon resources to keep your citizens safe and healthy

Considerations

- Necessities to live on the Moon
  - E.g., Air, Water, Rocket Fuel, Manufacturing, Power
- Volatiles
  - E.g., Water, Hydrogen, Helium, Nitrogen, Carbon
- Minerals
  - E.g., Silicon, Titanium, Aluminum, Iron, Potassium, Thorium
- Geologic structures
  - E.g., Lava tube
- Line of Communication
  - Near Side vs Far Side
- Landing and approach
  - E.g., hazard, signal obstruction

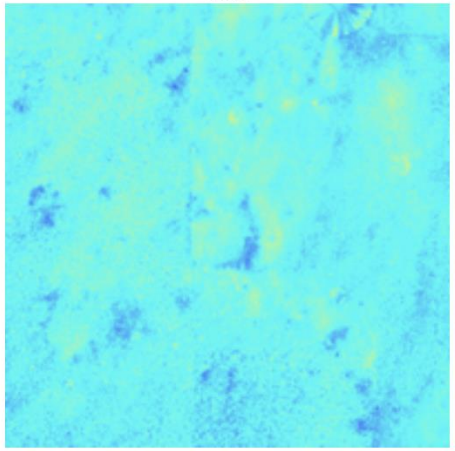
Iron Concentration

Search | Layers (1) | Downloads

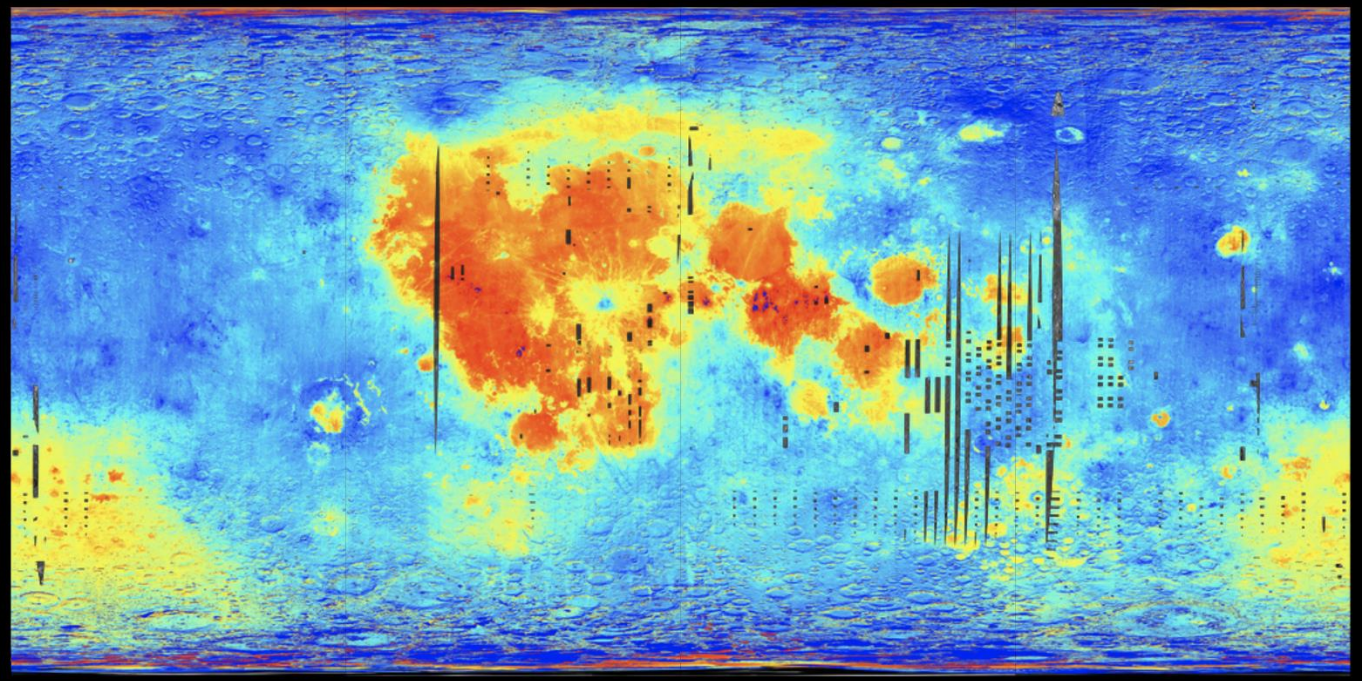
Clementine UVVIS FeO Weight-Percent

Legend | Hide Legend

Wt%-FeO
High : 20
12
10
8
Low : 0



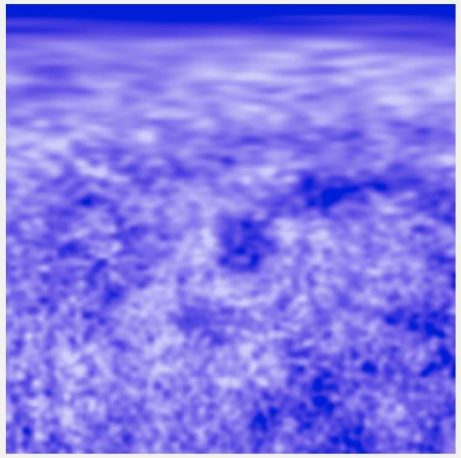
Clementine UVVIS derived mineral and optical maturity maps. These datasets were generated from the UVVIS mosaics warped to the ULCN2005 control network. For more information on how the data set was derived, please see: Lucey, P.G., Blewett, D.T., Taylor, G.J., Hawke, B.R., 2000. Imaging of lunar surface maturity. J. Geophys. Res. 105, 20377–20386. Lucey, P. G., G. J. Taylor, and E. Malaret , 1995, Abundance and distribution of iron on the Moon. Science, vol. 268, p. 1150-1153. Lucey, P. G., D. T. Blewett, and B. R. Hawke, 1997, Mapping the FeO and TiO2 content of the lunar surface with multispectral imagery. Journal of Geophysical Research, in press. Updated reference details: published in 1998 J. Geophys. Res., v. 103, no. E2, p. 3679



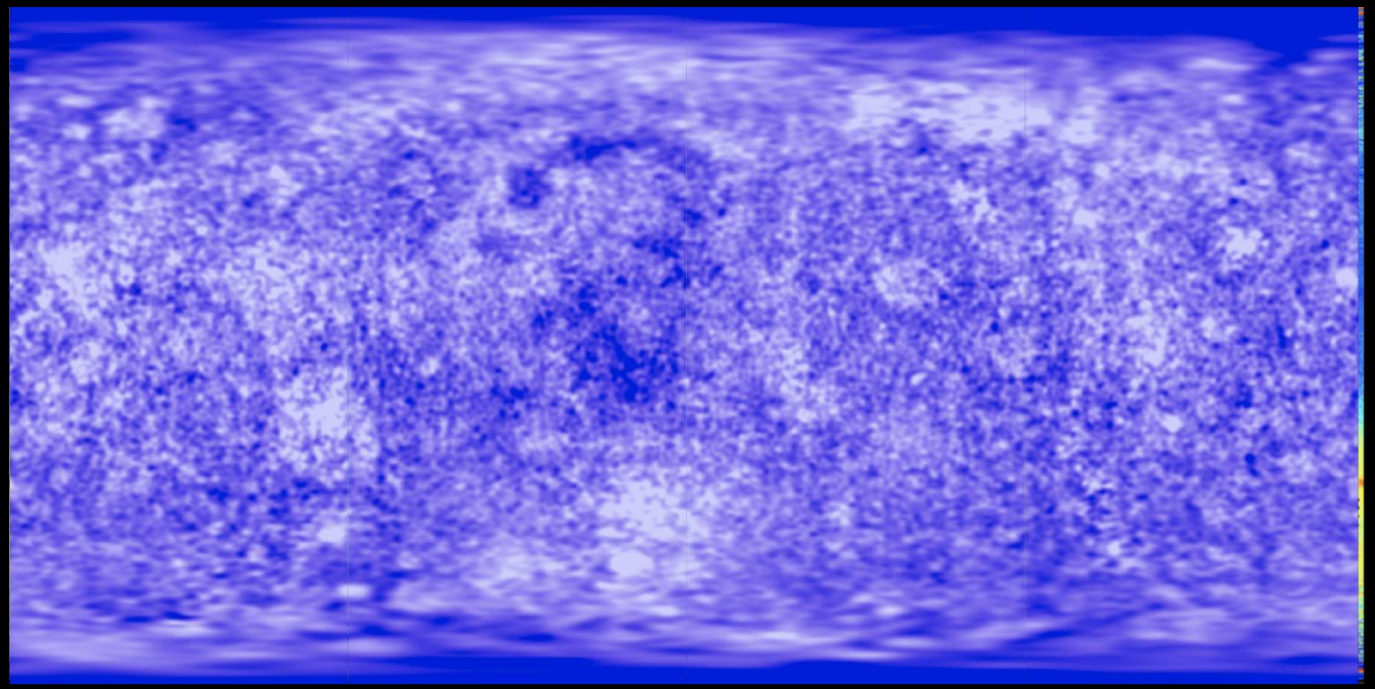
Hydrogen Concentration

LP NS H Abundance

egend Show Legend



The half degree hydrogen abundance data product contains data from the LP neutron spectrometer [Feldman et al., 1999]. Hydrogen abundances are derived from epithermal neutron data that has been corrected by thermal neutron data [Feldman et al., 2001c]. Equations 3 and 4 of Feldman et al. [2001c] show how the corrected epithermal data is converted into hydrogen abundances as parts per million (ppm). Note, however, that these abundances are not necessarily reliable in regions of high thorium and rare-earth element abundances [Maurice et al., 2001a]. The map bin size is 0.5 deg by 0.5 deg. This Lunar Prospector (LP) gamma ray special product and associated documentation have been prepared by the LP Spectrometer Team as part of a NASA Lunar Data Analysis Program. These spectrometer data products integrate data collected between January 16, 1998 and July 31, 1999. The data file descriptions for these products were provided by: William C. Feldman, Tom H. Prettyman, Richard D. Belian, Richard C. Elphic, Olivier Gasnault, David J. Lawrence, Stefanie L. Lawson, and Kurt R. Moore all of Los



Ice Exposures

Search | Layers *(1)* | Downloads

M3 Ice Exposures, South Polar

Legend Show Legend

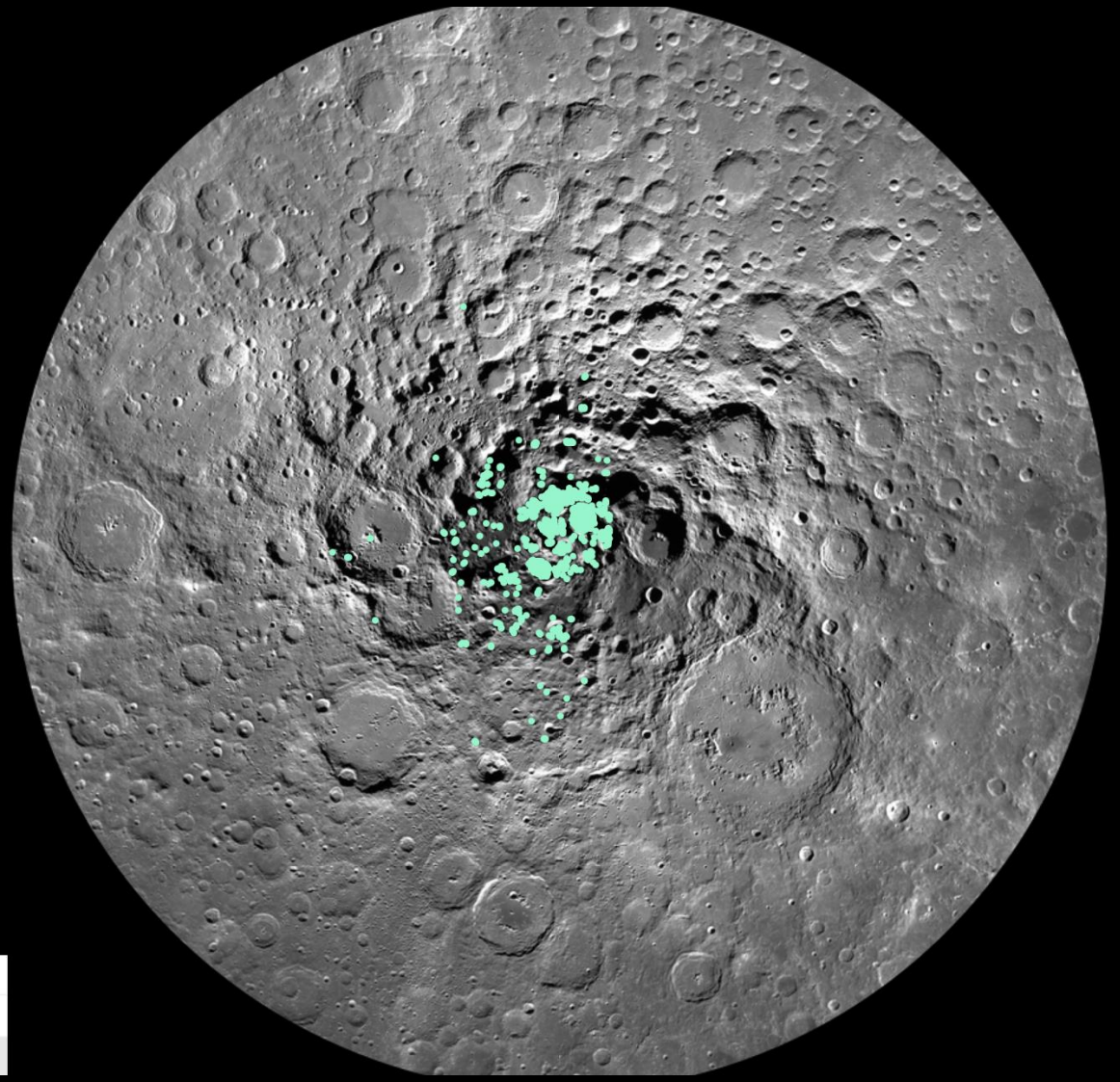
This is a vector dataset depicting ice exposures for the south polar region of the Moon. Ice exposure detections are constrained by the Moon Mineralogy Mapper [M(3)], Lunar Orbiter Laser Altimeter (LOLA), Diviner Lunar Radiometer Experiment, and Lyman Alpha Mapping Project (LAMP) instruments. This data represents the distribution of water-ice-bearing pixels extending from approximately 75°S to 90°S. This data contains 1119 individual vector points, each associated with XY coordinates. Each vector point represents an M(3) pixel, ~280m x 280m. The XY coordinates were plotted using ArcGIS and then reprojected to a south polar stereographic projection. This data was provided by: Shuai Li from the Department of Geology and Geophysics at the University of Hawaii.

Remove | View Metadata | Download Metadata

Download | Add to Downloads | Fly To | Manage Layer(s)

ttributes

Label	Value
bbox	-383180,-337536.5,338381.8,401775.5
instrument	Moon Mineralogy Mapper
mission	Chandrayaan-1
product Type	Mineralogy

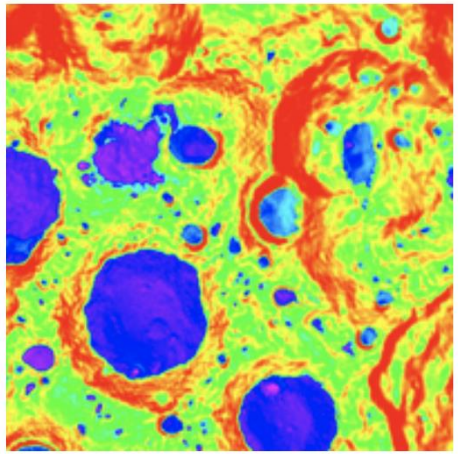


Maximum Temperature

Search | Layers (2) | Downloads

LRO Diviner Surface Temp Max S Pole, Color

egend Show Legend



Diviner will characterize temperature variations as a function of latitude, ongitude, time of day and season. Diviner will have the capability to make accurate radiometric measurements for the warmest and coldest surfaces on the planet, as well as simultaneous measurements of broadband solar reflectance. The Diviner dataset should be sufficiently complete to allow confident prediction of lunar surface temperatures in daytime, nighttime and polar thermal environments.

Remove | View Metadata | Download Metadata

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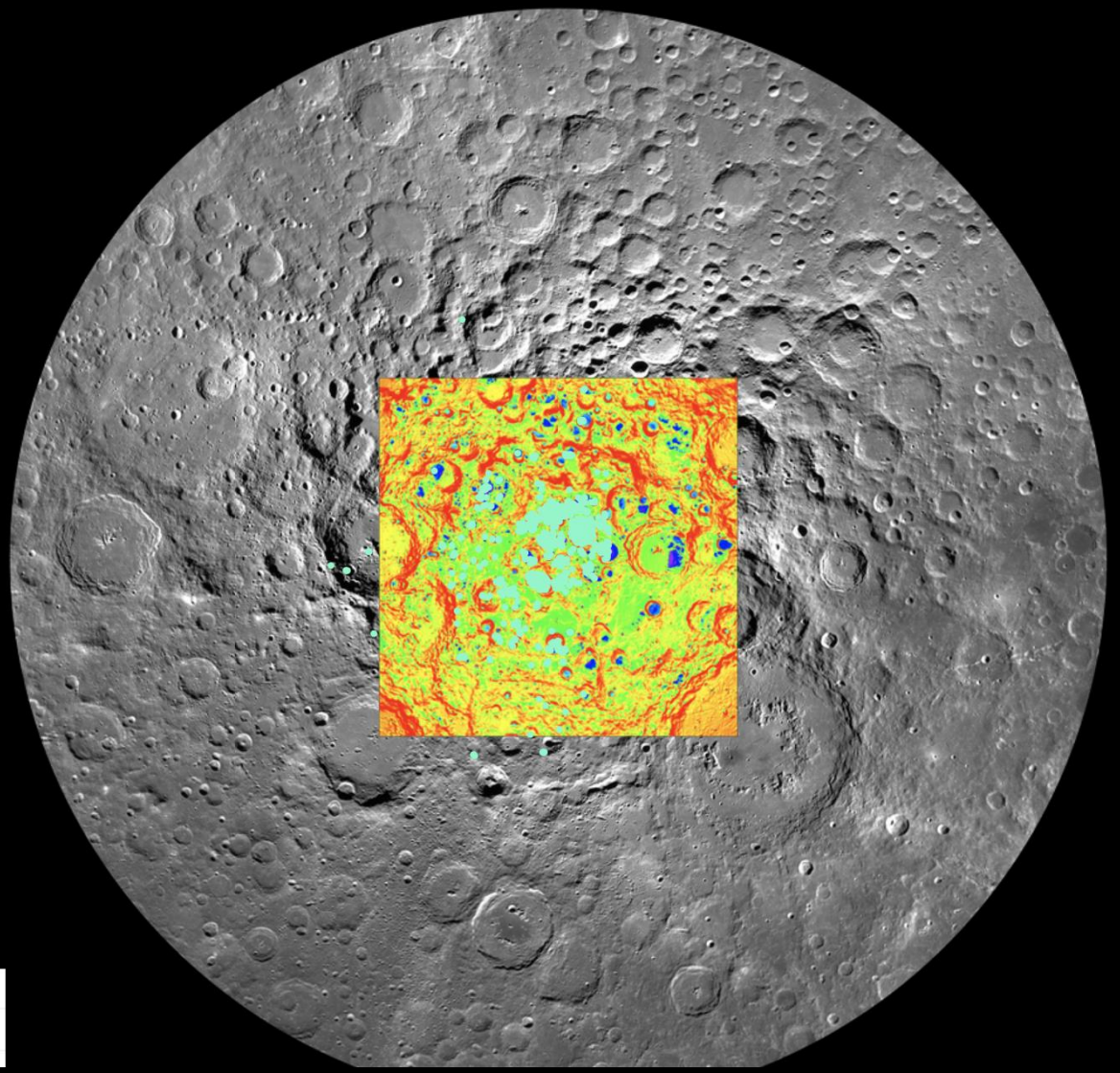

Thank you