Lunar Mapping & Mapping Portal (LMMP)
Vesta Trek
Mars Trek

Brian H. Day – SSERVI – brian.h.day@nasa.gov

Emily S. Law – JPL – emily.s.law@jpl.nasa.gov

Overview

- A set of data products, interactive tools and technology for exploration
  - Mission Planning
  - Scientific Research
  - Public Outreach

- Visualization, Analysis, 3D Printing, Data Service
  - Earth's Moon, Vesta, Mars, Earth
  - A variety of user interfaces (e.g., virtual reality goggles)
  - A variety of external platforms (e.g,. Eyes on Solar System, planetariums)

Background

Stakeholders:

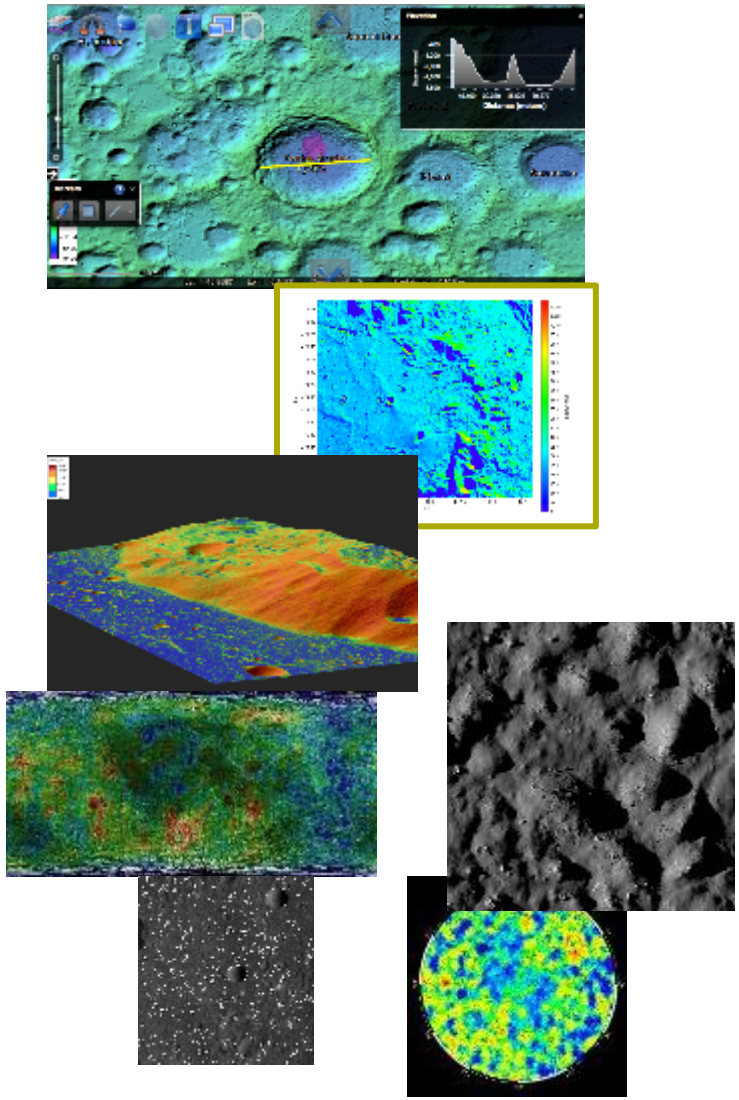
- HEOMD (PE: Bette Siegel)
- SMD (PE: Kristen Erickson)

Timeline:

- Support of Constellation Program – 2009
- First release of LMMP – 2011
- Transition to SSERVI – 2013
- Earth applications – since 2013
- Release of Vesta Trek – March, 2015
- Release of Mars Trek – July, 2015

LMMP (http://lmmp.nasa.gov)

- Analysis tools
  - Lighting, Slope, Hazard, Profile, Sun angle
- Browse, search and download of data products
- Visualization (with overlays)
- Collaboration (bookmark, group)
- 3D print and terrain view
- Data
  - LRO, Apollo, LP, GRAIL, Clementine, Chandrayaan-1, Kaguya
  - Gravity models, Imagery, DEMs, Hazards, Resources
- Users
  - Resource Prospector, Lunar scientists, International space agencies, Google X-Prize, EPO



LMMP (http://lmmp.nasa.gov)

New Data Products

- LOLA
  - Polar 10m/p DEM, Slope Map, Roughness Map, PSR Map
  - Global Roughness, Slope
- Diviner: 2013 CF Composition Map (update from 2011 version), Thermal Map, Rock Abundance Map
- Mini-RF: North Polar Mosaic including CPR, Colorized CPR, and First Stokes Parameter. This pre-publication data is available now for Resource Prospector site selection and analysis use thanks to Wes Patterson at APL. General availability on LMMP after publication.
- Kaguya TC Ortho Mosaic

LMMP (http://lmmp.nasa.gov)

Coming

- LOLA and TC Stereo DEM Merge
- Enhanced NAC coverage (working with Sam Lawrence at ASU)
- M^3 upon release of re-registered version by Lisa Gaddis and her team
- Min-RF South Polar Mosaic when it becomes available
- Variety of LAMP products
- A variety of products developed by Resource Prospector
- A new DEM that we will produce for Resource Prospector for a site to be specified
- Working with Bill Farrell and his SSERVI team to integrate their algorithm for a new surface potential analysis tool
- Working with David Kring and his SSERVI Team to integrate their Atlas of Sinuous Rilles
- Enhanced hazard analysis tool
- New crater analysis tool
- New path tool
- Working with JSC Astromaterials to integrate their database of lunar samples

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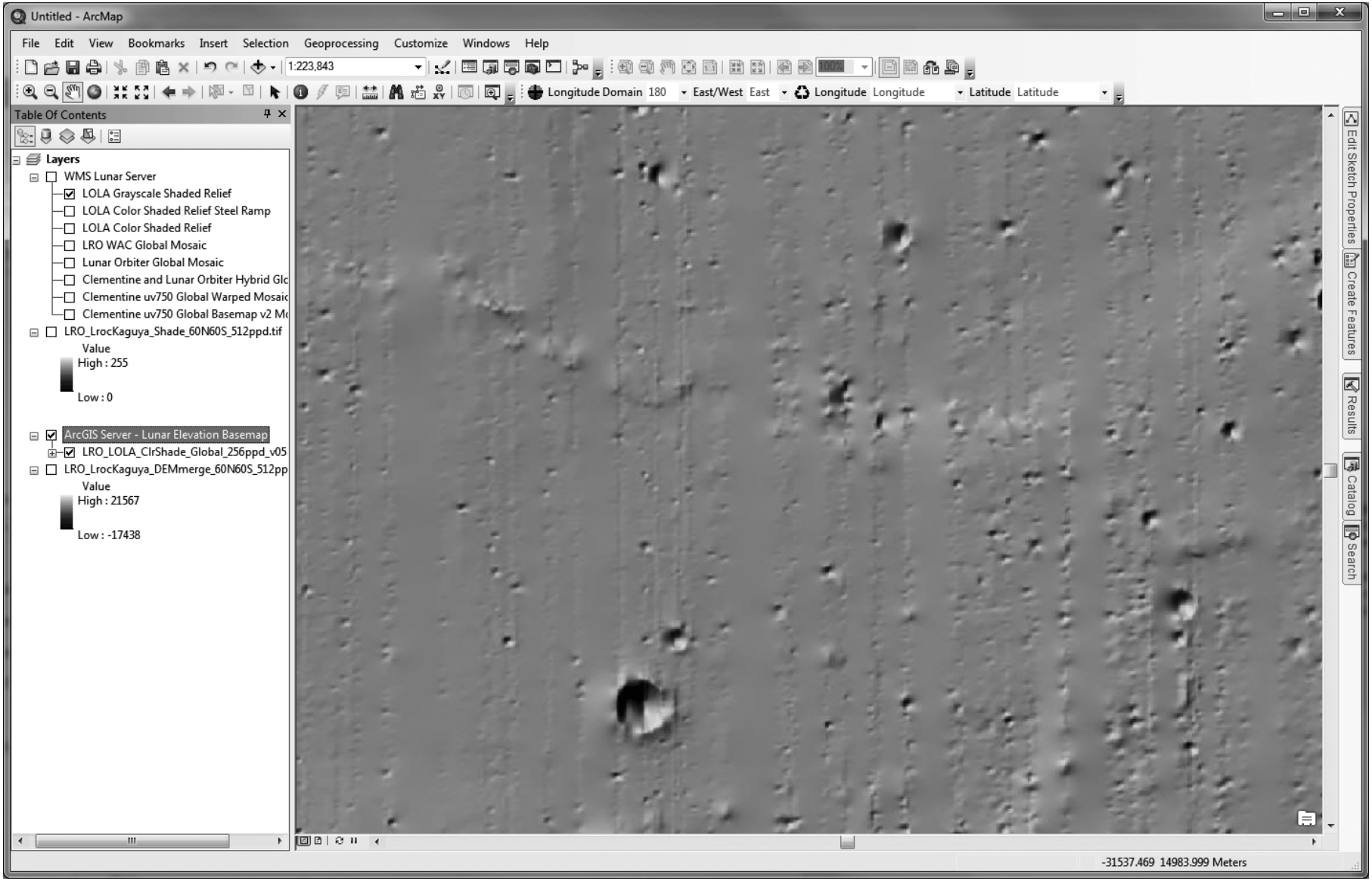
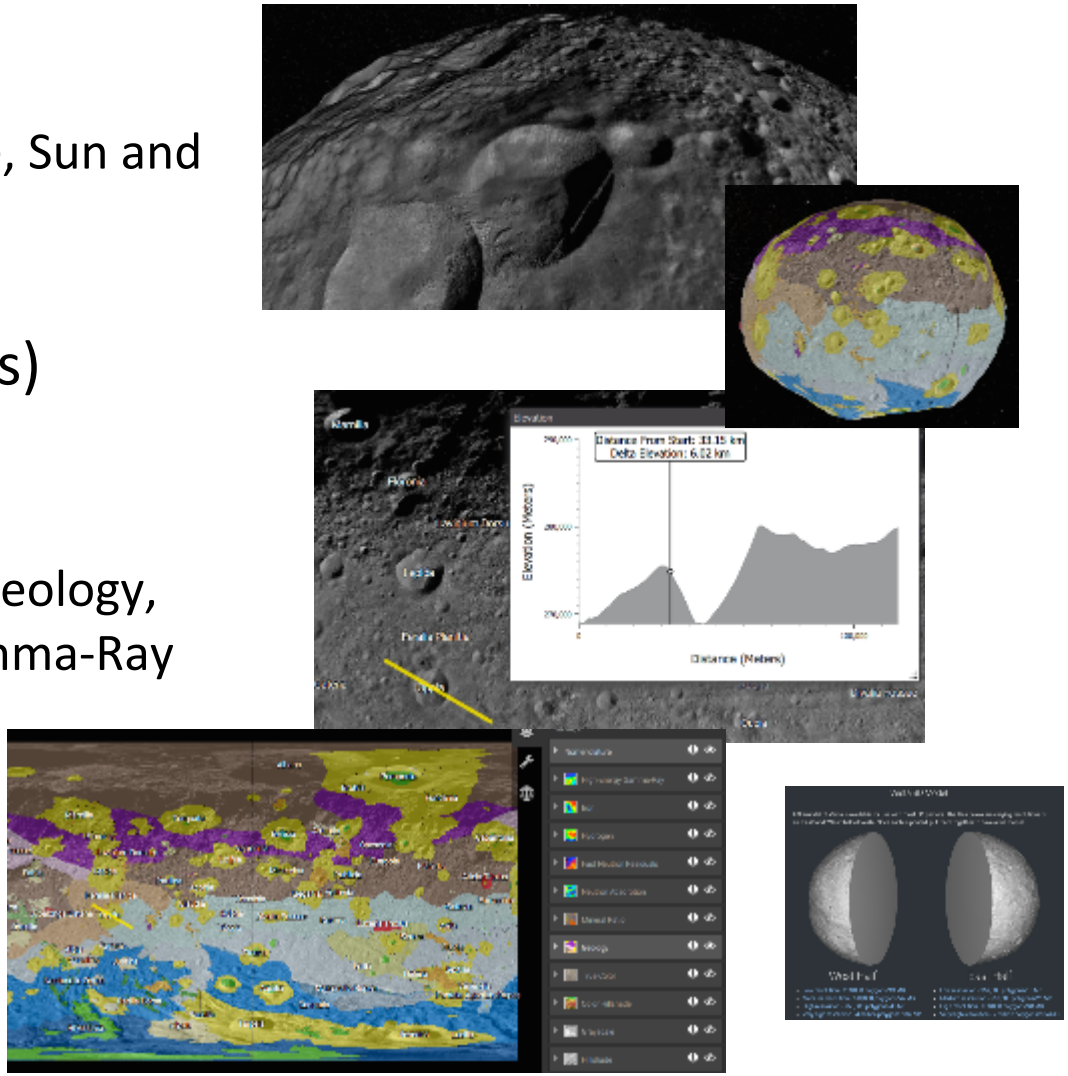


Vesta Trek
(http://vestatrek.jpl.nasa.gov)

- Analysis tools
  - Distance, Profile, Sun Angle, Sun and Earth Overhead
- Browse data products
- Visualization (with overlays)
- 3D fly over and printing
- Data
  - Iron, Hydrogen, Neutron, Geology, Hillshade, High-energy Gamma-Ray
- Users
  - EPO, Scientists



Vesta Trek
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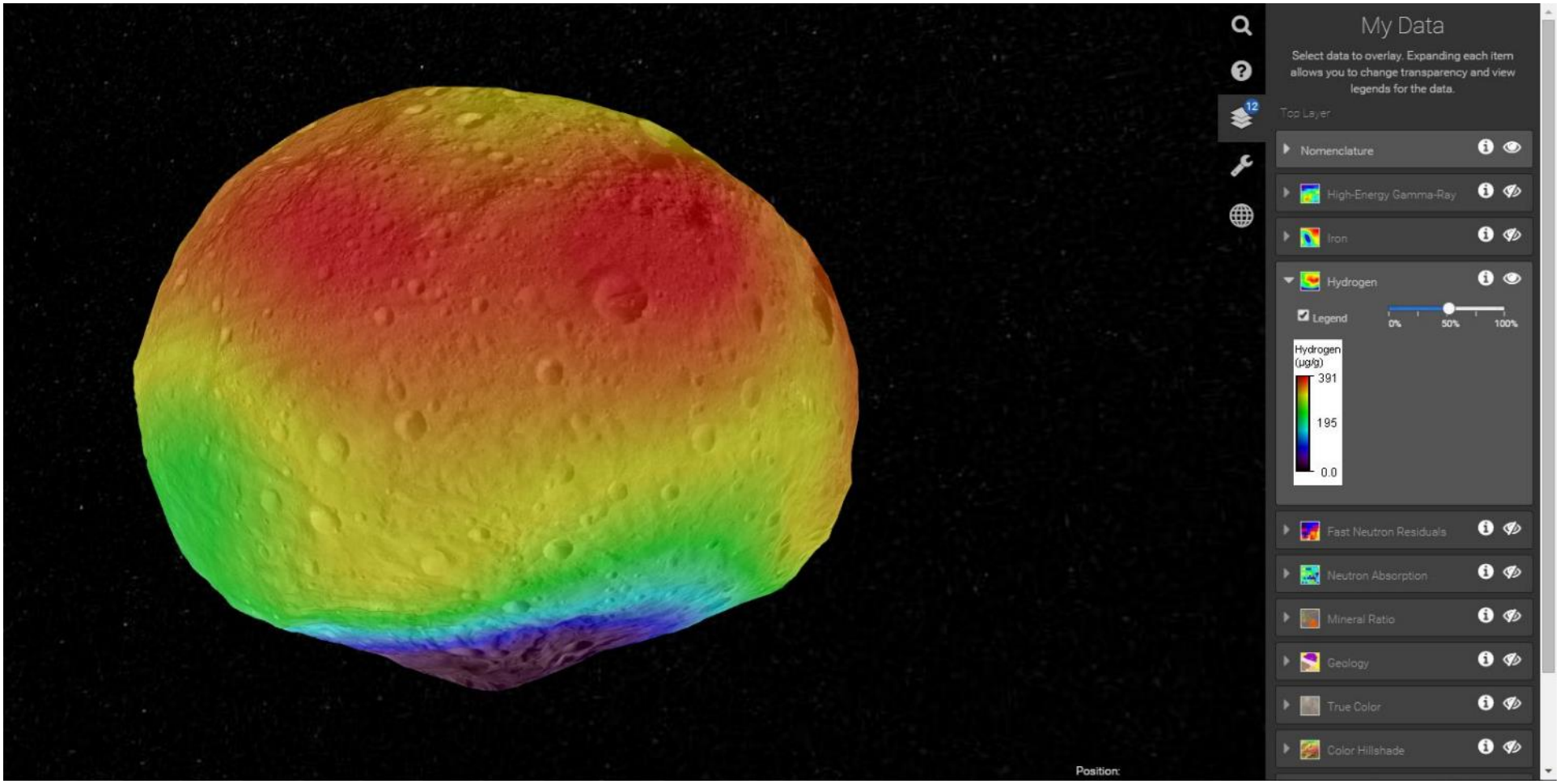

Vesta 3D view with Hydrogen Abundance layer overlaid.

Vesta Trek
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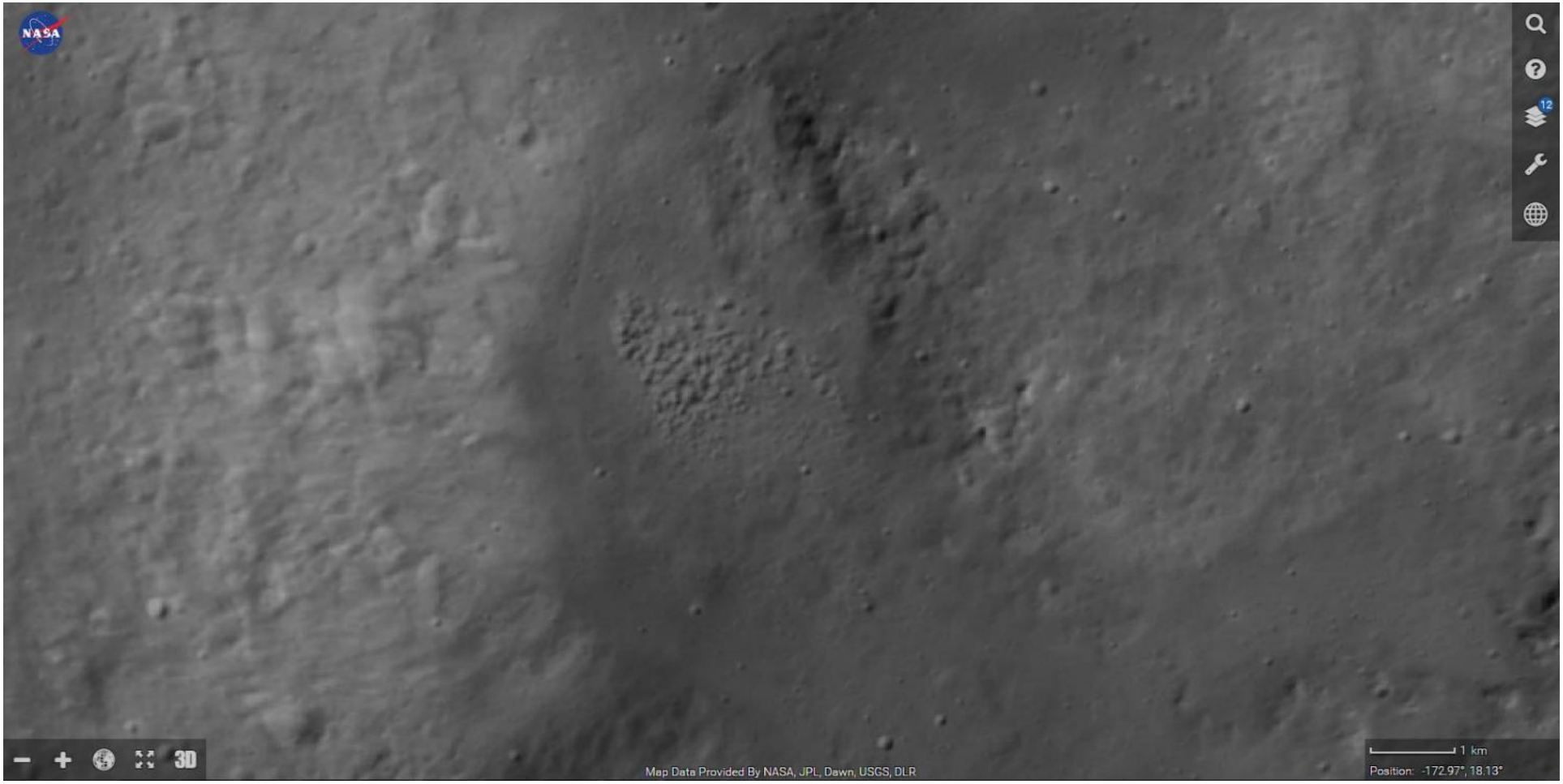
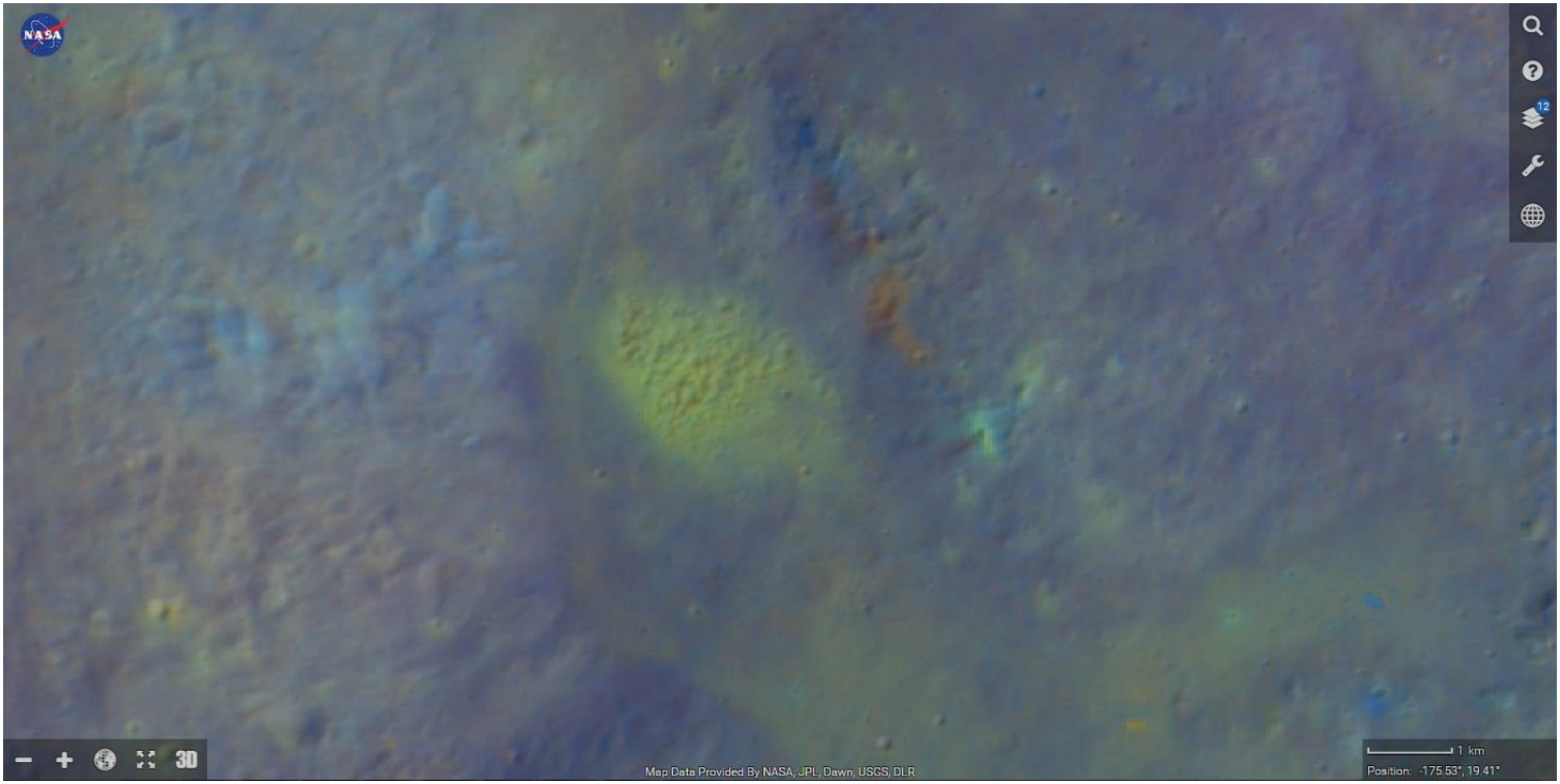


Pitted terrain north of Marcia

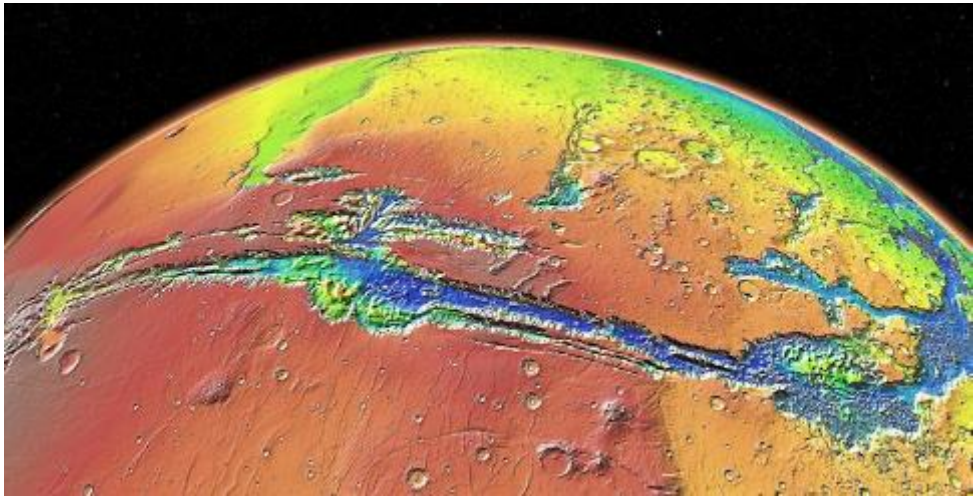
Vesta Trek
(http://vestatrek.jpl.nasa.gov)

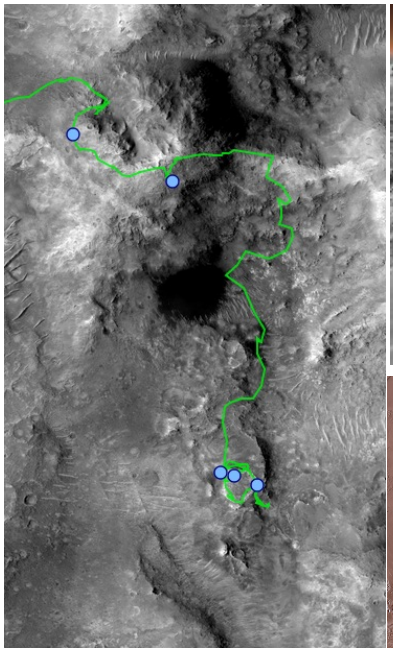


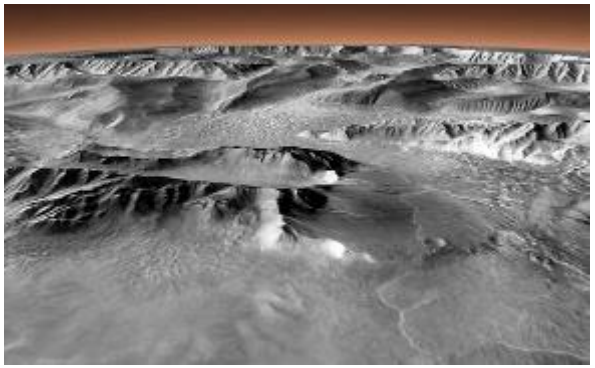
Pitted terrain north of Marcia with the addition of the Vesta Trek Mineral Ratio layer using a mosaic of Dawn HAMO frames with band ratios emulating the Clementine Mineral Ratio Mosaic.

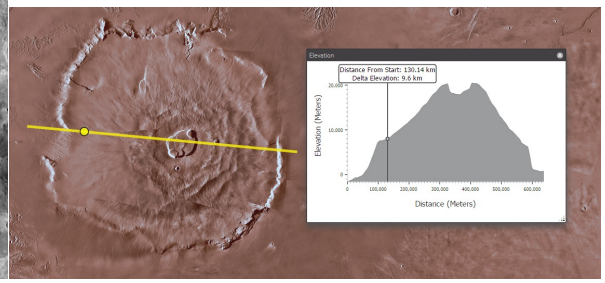
Mars Trek (http://marstrek.jpl.nasa.gov)

- Analysis tools
  - Distance, Profile, Sun Angle, Spacecraft Overhead
- Landing Site features
  - MER, MSL, Phoenix, Pathfinder
- Visualization (with overlays)
- 3D fly over and printing
- Data
  - Mars Reconnaissance Orbiter, Mars Odyssey, Mars Global Surveyor, Viking
  - Mars Express HRSC coming soon
- Users
  - EPO, Scientists









Mars Trek
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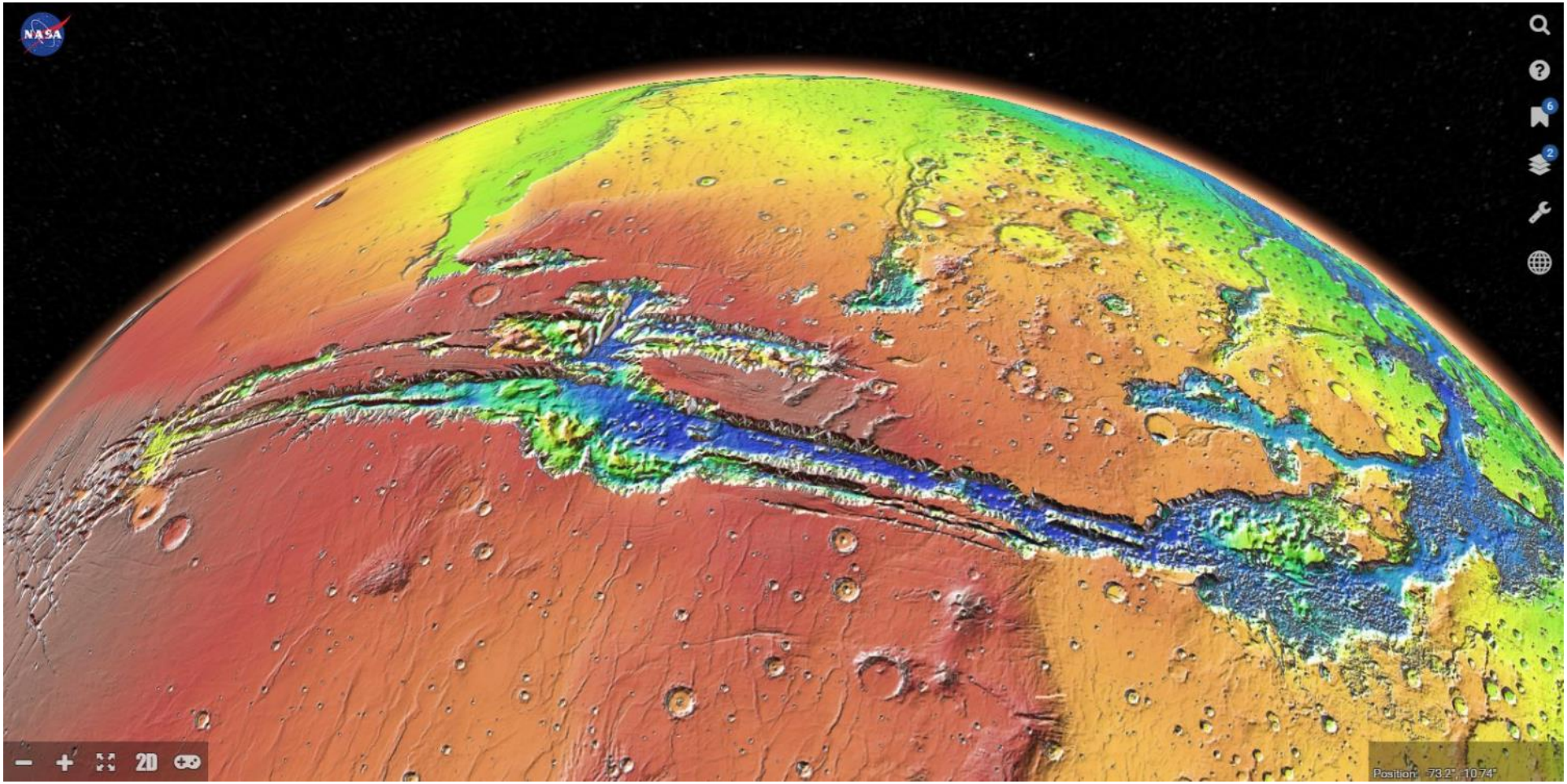
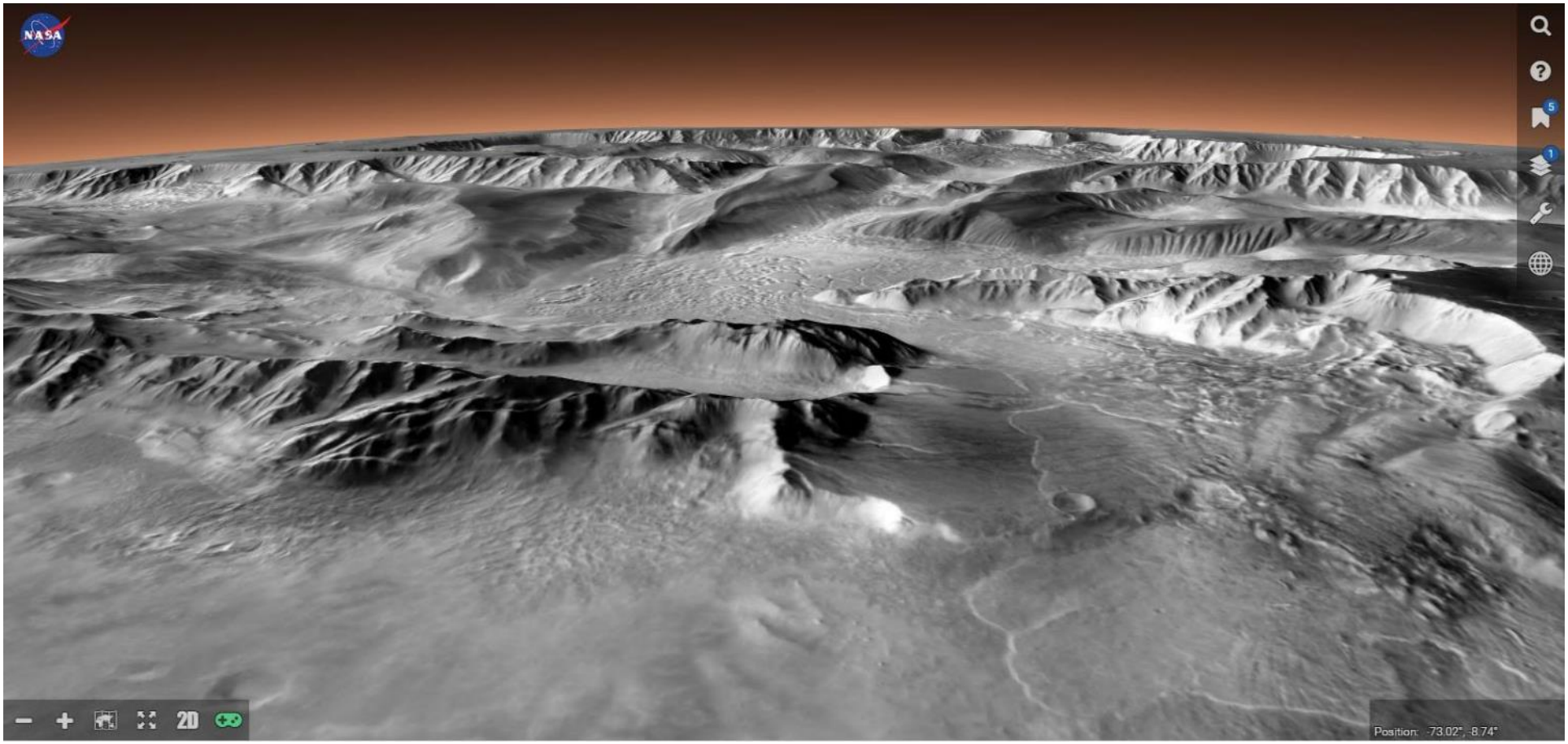


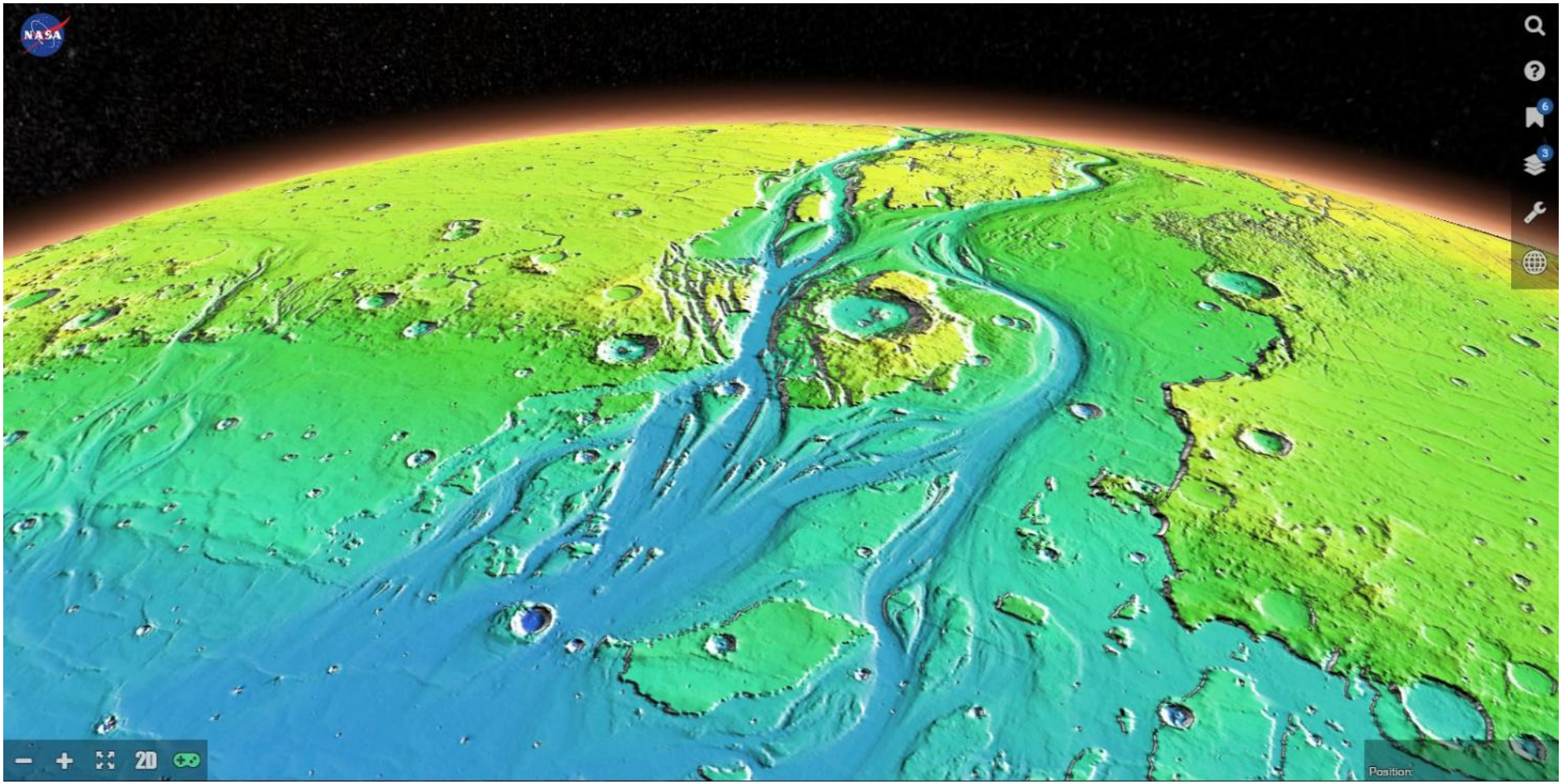
Valles Marineris: The data for this Mars Trek visualization was acquired using the Mars Orbiter Laser Altimeter (MOLA) instrument aboard NASA's Mars Global Surveyor spacecraft (MGS).

Mars Trek
(http://marstrek.jpl.nasa.gov)



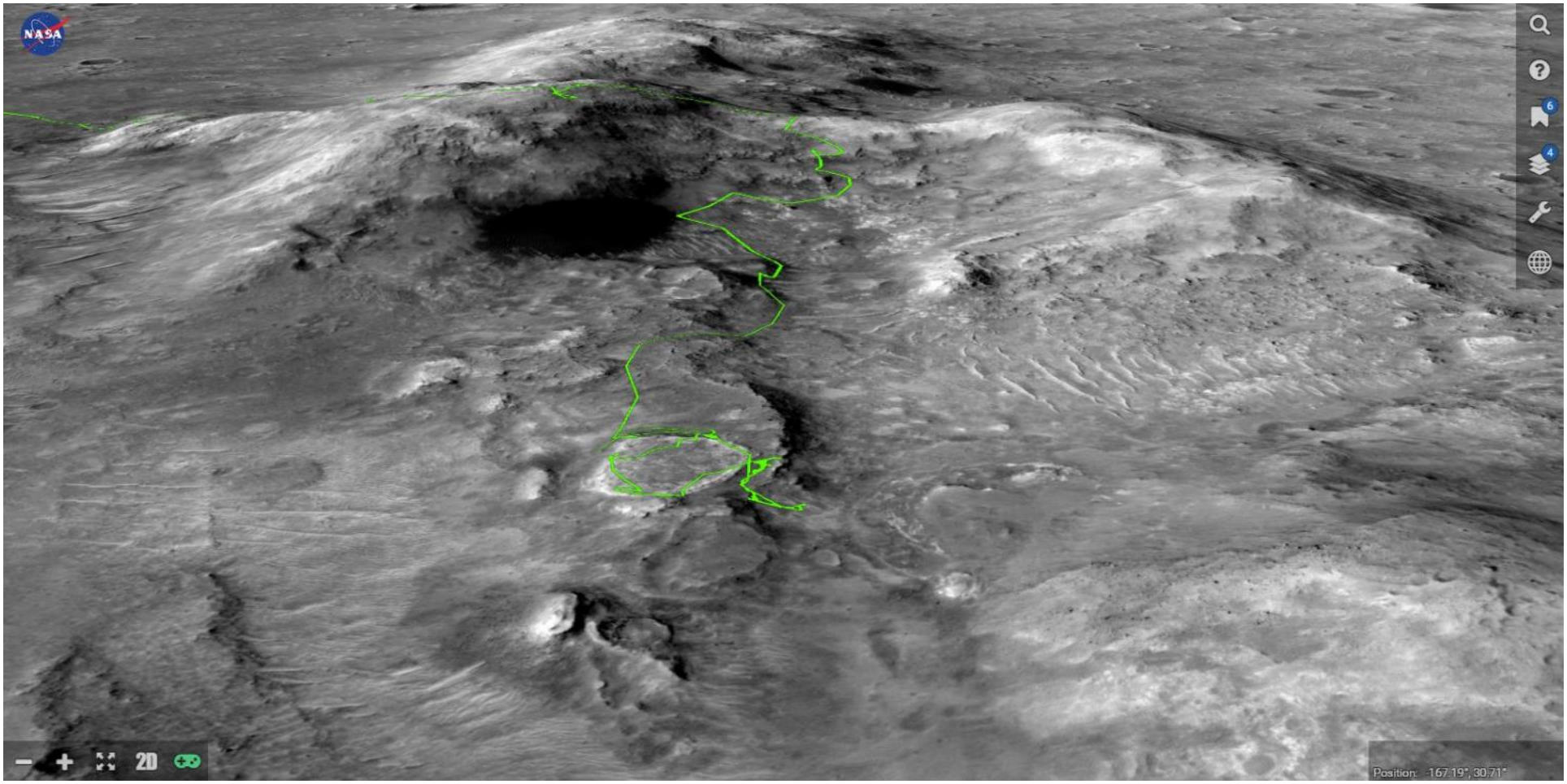
Valles Marineris: This Mars Trek Visualization was made using daytime infrared data from the Thermal Emission Imaging System (THEMIS) instrument aboard NASA's Mars Odyssey spacecraft.

Mars Trek
(http://marstrek.jpl.nasa.gov)



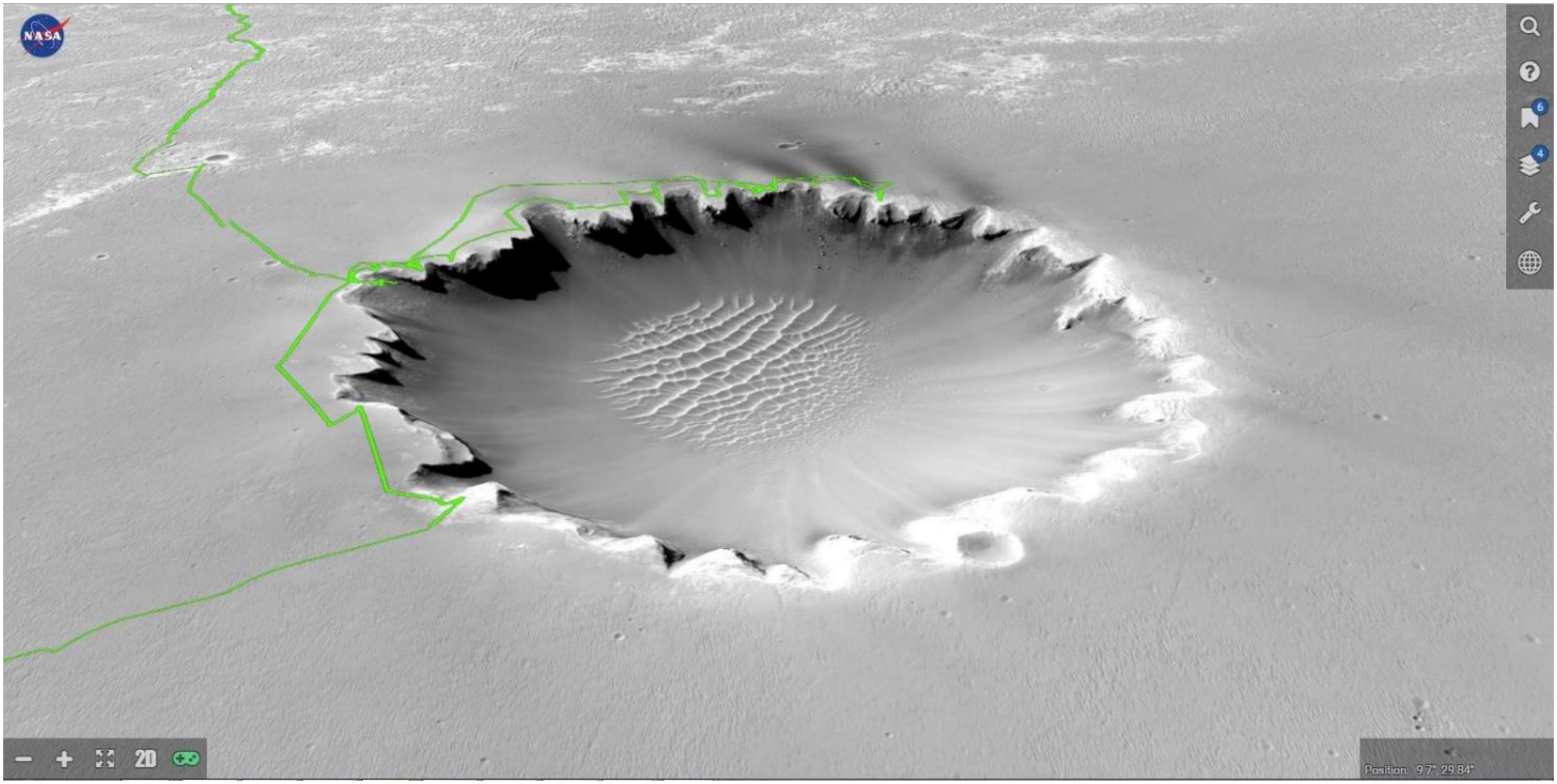
Kasei Valles: MOLA laser altimetry data from the orbiting Mars Global Surveyor spacecraft.

Mars Trek
(http://marstrek.jpl.nasa.gov)



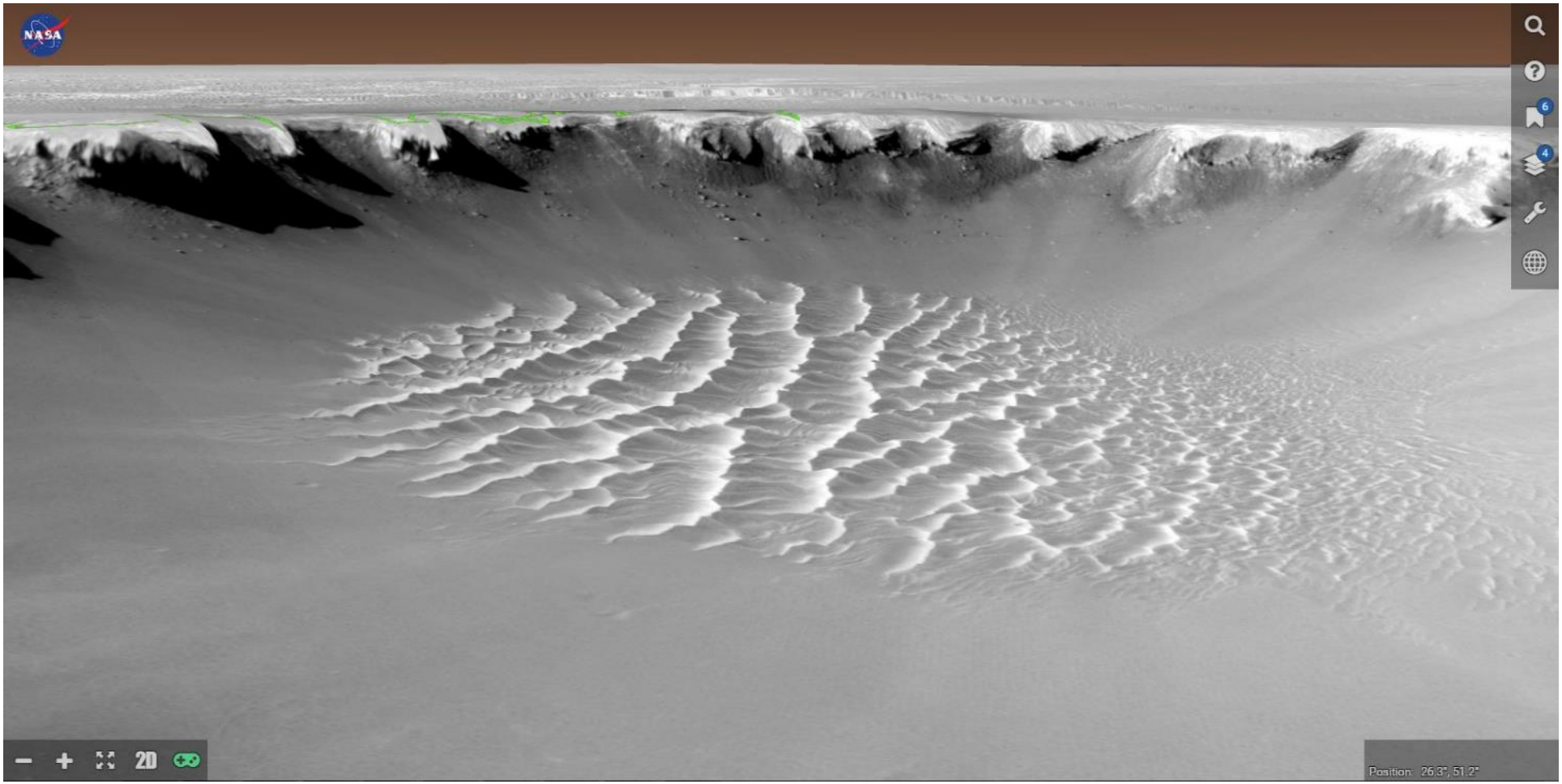
Columbia Hills: Mars Trek shows Spirit's path in green on an image generated using data from the HiRISE instrument aboard the Mars Reconnaissance Orbiter.

Mars Trek
(http://marstrek.jpl.nasa.gov)



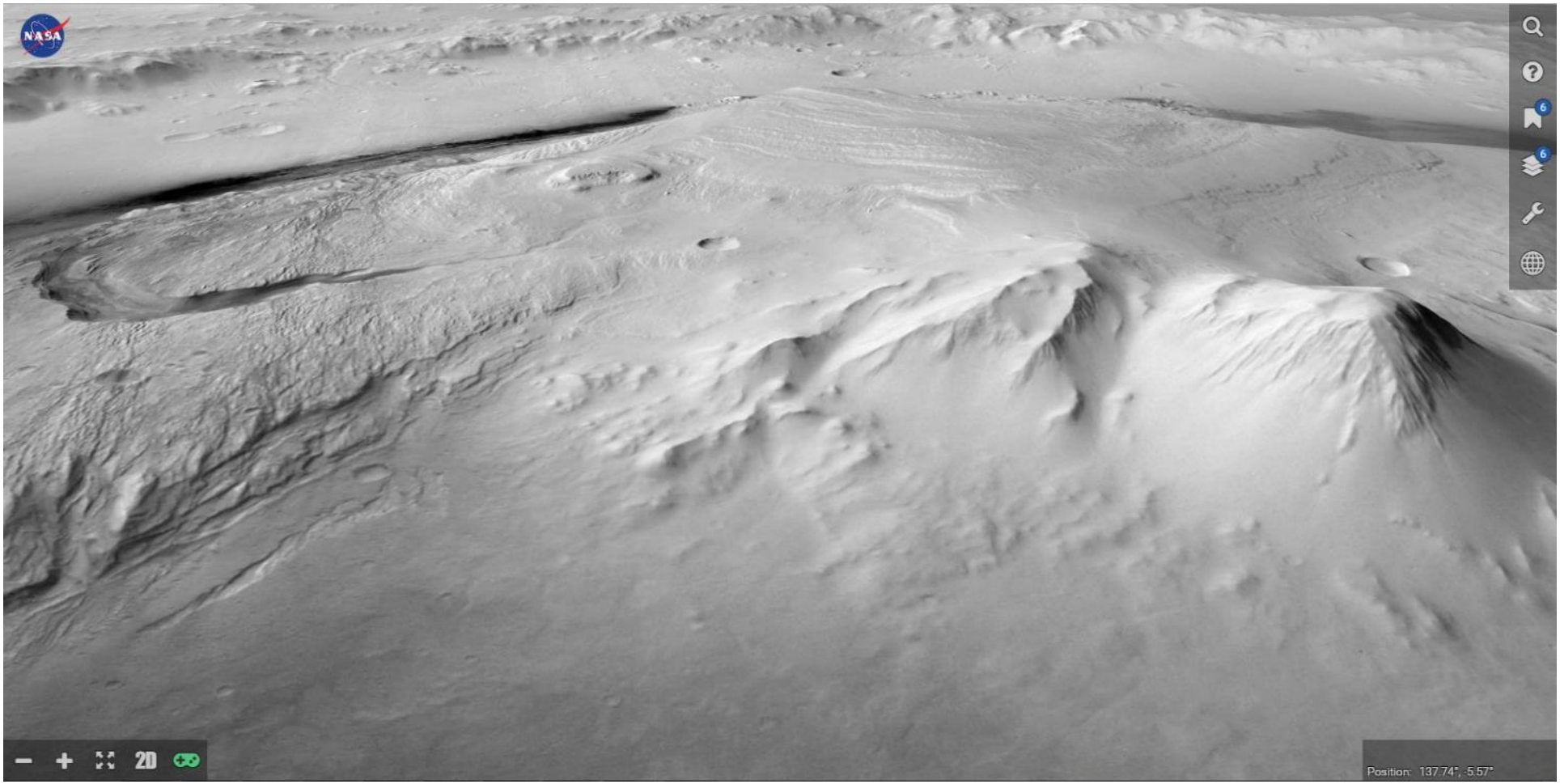
Victoria Crater: Visualization using data from the HiRISE camera aboard the Mars Reconnaissance Orbiter. Opportunity's path here in green.

Mars Trek
(http://marstrek.jpl.nasa.gov)



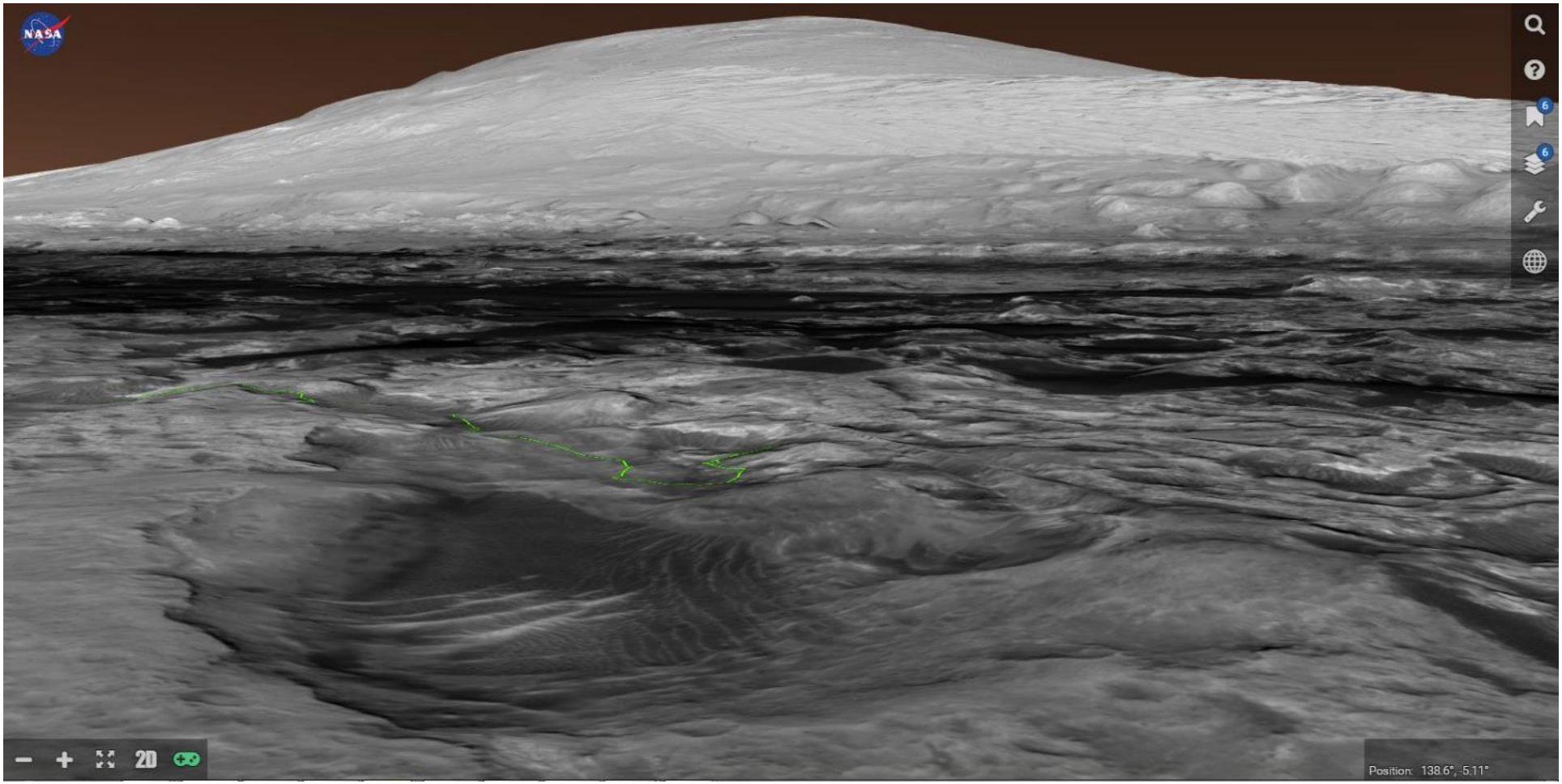
Victoria Crater: Ground level view using data from the HiRISE camera aboard the Mars Reconnaissance Orbiter. Opportunity's path here in green.

Mars Trek
(http://marstrek.jpl.nasa.gov)



Mount Sharp: Visualization using data from the CTX camera aboard the Mars Reconnaissance Orbiter.

Mars Trek
(http://marstrek.jpl.nasa.gov)



Mount Sharp: Visualization using data from the HiRISE instrument aboard the Mars Reconnaissance Orbiter to look south from the area of the Curiosity rover, whose path is shown in green.

User Experience

Web
REST API

HyperWall

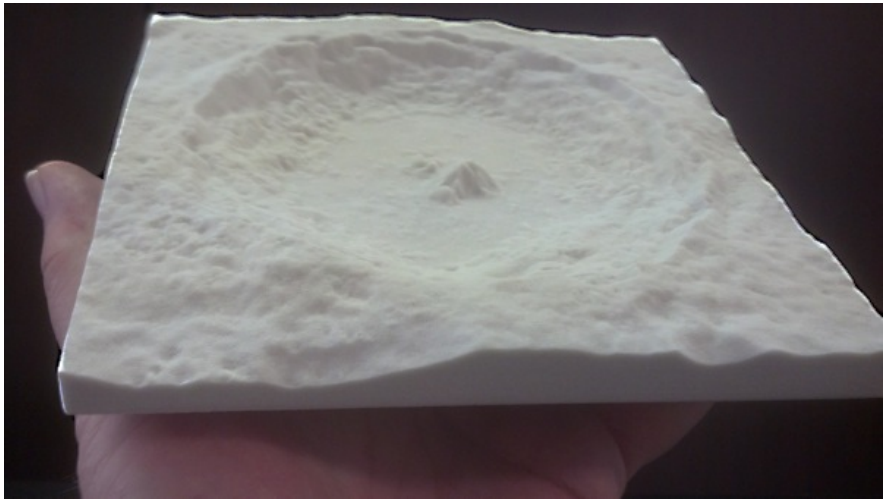
Mobile Apps

3D Goggles

Touch Table

3D Printing

All 3 portals allow users to select areas on the surface and generate STL files for 3D printers.



Going Forward

- Extension to other planetary bodies
  - Ceres, Phobos, Deimos, Comet CG (67P), Mercury
- Landing site selection
  - Mars 2020 and Human Landing Site Candidates
  - Lunar Mission One
- Expanding collaboration
  - International space agencies (ESA, KARI)
  - Research (SSERVI PI institutions)
  - NASA Citizen Science Forum
  - Have been included in SMD Education Infrastructure
  - Smithsonian National Air & Space Museum
  - Planetariums (Hayden, Cal Academy, and many more to come)
- Core software and capabilities for Data Science across disciplines & multi-agencies
  - Planetary, Earth, Astrobiology, Biomedicine
  - NASA, NSF, NIH

Thank You!

Jet Propulsion Laboratory
California Institute of Technology

Come see the demonstration across the hall in Room 103/104

Eddie Arevalo[1], Jen Baer[2], Bach Bui[1], George Chang[1], Brian Day[2], Kyle Dodge[1], Richard Kim[1], Emily Law[1], Shan Malhotra[1], Joseph Minafra[2], Ashcon Nejad[2], Syed Sadaqathullah[1], Teague Soderman[2]

1-JPL 2-SSERVI Central

Summer Students: Natalie Gallegos, Peter Kundzicz, Saman Saeedi