

## Mercury Trek: A New Online NASA Visualization and Analysis Portal

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In its investigations of the planet Mercury, NASA's MESSENGER returned an immense amount of data detailing the dynamic surface of our solar system's innermost planet. As the Japanese and European space agencies prepared for the launch of BepiColombo, the next mission to explore Mercury, BepiColombo's project science team asked NASA to produce a new portal within the Solar System Treks suite (<https://trek.nasa.gov>) featuring data returned by MESSENGER from Mercury. This new portal would be used both for mission planning and for public outreach by the BepiColombo mission. While initially populated with Messenger data, the portal is also being designed to facilitate visualization, analysis, and dissemination of data from BepiColombo after it commences science operations in orbit around Mercury. The initial release of the Mercury Trek in 2019 shortly followed the launch of BepiColombo on its journey to Mercury.

The initial release of Mercury Trek features data products from the Mercury Dual Imaging System (MDIS) instrument that operated aboard NASA's MErcury Surface, Space ENvironment, GEochemistry and Ranging (MESSENGER) mission while in orbit around Mercury from 2011 to 2015. These products include the MDIS Global Mosaic, MDIS BDR Global Mosaic, MDIS Color Global Mosaic, MDIS MD3 Color Global Mosaic, MDIS Enhanced Color Global Mosaic, MDIS LOI (low-incidence angle) Global Mosaic, MDIS Global Digital Elevation Model (DEM), and MDIS Color Hillshade Global map derived from the DEM. Mercury Trek's data visualization capabilities make it easy to stack and blend different data layers in order to optimize depictions of a wide variety of surface features.

Data products can be viewed in equatorial, or polar projected views, or on an interactive 3D globe. The Trek interface allows the user to maneuver a first-person visualization of "flying" across the surface of the Mercury.

Analysis tools make it easy to measure distances (either straight-line or along a user-defined path) and to create elevation profiles for surface features. Users can draw user-defined bounding boxes across Mercury's terrain to generate STL or OBJ files for 3D printing. They can also draw a freehand path anywhere across the surface and have Mercury Trek return a QR code that can be scanned into a smartphone (Android or iOS). The smartphone can then be placed into a pair of inexpensive cardboard-compatible goggles. The user will then be able to fly their defined path in virtual reality.

We intend to continue working with the Bepi-Colombo mission and the greater planetary science community to enhance the new Mercury Trek portal with additional data products, and solicit suggestions from the community.

Mercury Trek is the latest addition to the NASA Solar System Treks Project, available at <https://trek.nasa.gov>. NASA's Solar System Trek online portals for lunar and planetary mapping and modeling provide web-based suites of interactive data visualization and analysis tools to enable mission planners, planetary scientists, students, and the general public to access mapped data products from past and current missions for the Moon, Mars, Vesta, Ceres, Titan, seven of Saturn's smaller icy moons (Dione, Enceladus, Iapetus, Mimas, Phoebe, Rhea, and Tethys), and now Mercury. As web-based toolsets,

the portals do not require users to purchase or install any software beyond current web browsers. These portals are being used for site selection and analysis by NASA and a number of its international partners, supporting upcoming missions.

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