



Cartography and Imaging
Sciences Node

U.S. Geological Survey

THE CARTOGRAPHY & IMAGING SCIENCES NODE OF THE NASA PLANETARY DATA SYSTEM

AKA The Imaging Node (“Imaging,” IMG, PDS-IMG)

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Cartography and Imaging Sciences Node

Jet Propulsion Laboratory

U.S. Geological Survey

- Curator of NASA's larger digital image collections from past, present and future planetary missions
 - Terrestrial planets, icy satellites
 - **~1.5 PB, growing ~100 TB/yr**
- Develops & supports archive standards for
 - Image data formats
 - Documentation of observation and acquisition parameters, image properties, etc. (metadata)
 - Image calibration, documentation
- Supports validation, delivery of digital image archives, ancillary & supporting information
 - Landed and orbital cameras and imagers, metadata
 - Cartographic products such as mosaics, maps, DEMs, geospatial databases, etc.
 - Links to heritage, publications, figures, etc.
- Leverages USGS/ISIS software to serve processed, derived data products
 - **When ISIS is used**, supports pipeline processing from raw to calibrated, photometrically corrected, map-projected products

The screenshot shows the homepage of the PDS Cartography and Imaging Sciences Node. At the top, it features the NASA logo and the text 'National Aeronautics and Space Administration'. Below this is the PDS logo and the title 'Cartography and Imaging Sciences Node'. A navigation bar includes links for 'HOME', 'DATA VOLUMES INDEX', 'ALL DATA HOLDINGS', 'DATA PORTAL', 'DATA RELEASES', 'TOOLS & TUTORIALS', and 'HELP'. The main content area is divided into several sections: 'Proposer Help', 'PDS Annex of Geospatial Products', 'Planetary Image Atlas', 'Marsviewer', 'Photojournal', 'PILOT', 'Map-a-Planet', 'Data Portal', 'Data Release Calendar', and 'Subscription Manager'. The 'Welcome' section provides an overview of the node's role as the curator of NASA's primary digital image collections. The 'Latest News' section lists recent releases, including 'Lunar Orbiter Data Searchable Through Atlas', 'Cassini ISS, RADAR & VIMS Release #63', 'Mars Odyssey Release #63', 'Mars Odyssey Release #63', 'Juno Release #5', 'Mars Exploration Rover (MER) Release #65', 'Mars Science Laboratory (MSL) Release #17', and 'Lunar Reconnaissance Orbiter (LRO) Release #33'. A 'Featured Image' section displays a photograph of the InSight lander on the surface of Mars, with a caption titled 'The InSight Lander'.

<https://pds-imaging.jpl.nasa.gov/>



Jet Propulsion Laboratory

Cartography and Imaging Sciences Node

U.S. Geological Survey

Science Discipline Focus: Cartography & Imaging Science

- Interdisciplinary expertise
 - Instrument/image geometry, cartographic data acquisition & processing
 - Orbital & landed camera instrument design, data processing & calibration
 - Detailed geometric & physical characterization of cameras
 - Planetary remote sensing at UVVIS to thermal to RADAR wavelengths
 - Single, multi- and hyperspectral images
 - Cartographic & geospatial data analysis
 - Geographic information systems, geologic & thematic mapping, 3D terrain mapping & analysis, slope & hazard mapping, site characterization
 - Data engineering & informatics, data mining

- Serves data from the NASA collection of digital planetary images
 - Terrestrial planetary surfaces
 - Mercury, Venus, Earth, Moon, Mars, Mars' moons Phobos and Deimos, asteroids Gaspra, Ida
 - Icy and outer Solar System satellites, dwarf planets
 - 9 moons of Jupiter (Io, Europa, Ganymede, Callisto, etc.)
 - 23 moons of Saturn (Titan, Enceladus, Iapetus, etc.)
 - 2 moons of Neptune (Triton, Nereid)
 - 5 moons of Uranus (Ariel, Titania, etc.)
 - Vesta, Ceres, Pluto, Charon

<https://pds-imaging.jpl.nasa.gov/>



Jet Propulsion Laboratory

Cartography and Imaging Sciences Node

U.S. Geological Survey

- **Mission Interface**

- Work with imaging instrument teams to ensure cost-effective data delivery to PDS and public
- Apply systems engineering principles to data to ensure rapid identification, easy access & download of PDS data

- **Data Delivery & Cartographic Support**

- Support delivery of planetary image data in raw & derived formats
- Deliver improved ancillary data (pointing, calibration) resulting from radiometric, geodetic & cartographic processing, restoration, scientific research, etc.

- **Data User Support**

- Maintain and support online data, provide state-of-the-art search & access tools
- Provide sophisticated tools & instructions for simple to complex data interaction by users
- Provide training, expert assistance to users for cartographic and scientific data analysis (LPSC, Planetary Data Users workshops, etc.)



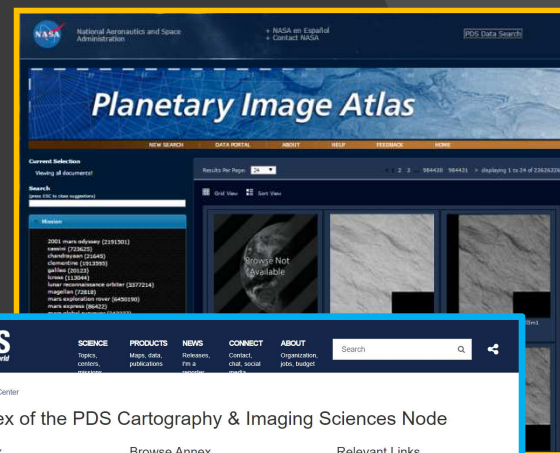
Cartography and Imaging Sciences Node

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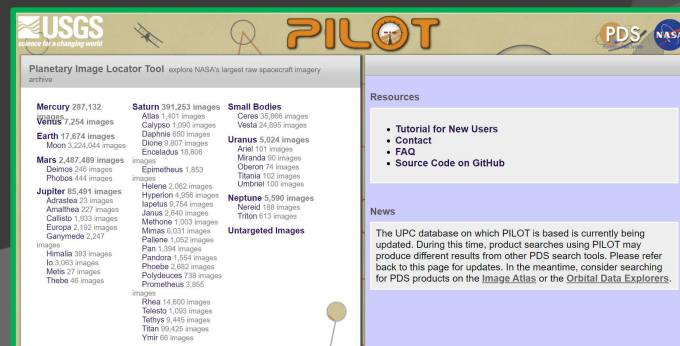
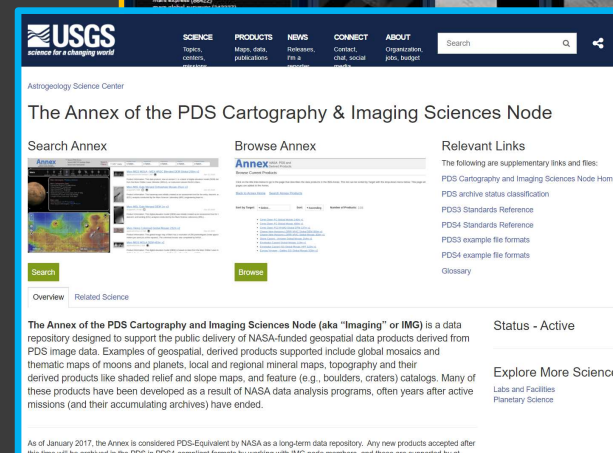
IMG OFFERS BOTH **DATA DELIVERY SYSTEMS**

- Planetary Image Atlas
- Data Portal
- Photojournal
- Map-A-Planet
- Annex



AND **DATA PROCESSING SYSTEMS**

- Planetary Image Locator Tool (PILOT)
- Map Projection on the Web (POW)



<https://pds-imaging.jpl.nasa.gov/>



IMG DATA DELIVERY SYSTEMS (1 OF 4)



○ Planetary Image Atlas

- Faceted searches based on image label data, geographic coordinates, etc.
 - Start by selecting Mission at the top, then Instrument, etc.
 - View results as browse at right
 - Select desired images, then download or bulk download (includes labels)
- Beta: Supports landmark feature classification and searches or “Image Content”
 - Available for MRO HiRISE, MSL MAHLI & MASTCAM, Cassini ISS and Galileo SSI images
 - Features: Craters, dark streaks, dunes, etc.
- Online tutorial:
 - <https://pds-imaging.jpl.nasa.gov/Atlas/intro.html>
- <https://pds-imaging.jpl.nasa.gov/search/>

<https://pds-imaging.jpl.nasa.gov/>



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PDS Imaging Node
National Aeronautics and Space Administration
Jet Propulsion Laboratory
U.S. Geological Survey

HOME | DATA VOLUMES INDEX | ALL DATA HOLDINGS | DATA PORTAL | DATA RELEASES | TOOLS & TUTORIALS | HELP

Mission Info	Instruments	Targets	Data Access Documentation, Tutorials	Status
 Cassini-Huygens	ISS Radar VIMS	Moon Jupiter Saturn	Atlas III Product Search Online Data Volumes Documentation	Latest release #43 includes ISS, RADAR, & VIMS data October 1, 2015
 Chandrayaan-1	Moon Mineralogy Mapper (M ²)	Moon	Atlas III Product Search Online Data Volumes Documentation	Release #4 Volume CHIM2_0004 containing Chandrayaan-1 Lunar Orbiter (LO-1) Moon Mineralogy Mapper (M ²) reduced image data, Optical Period 1 and 2, Level 2. Note: there was a minor update to CHIM2_0003 described in the ERRATA.TXT

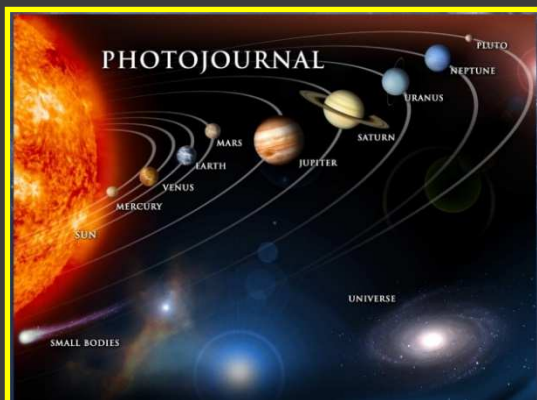
IMG DATA DELIVERY SYSTEMS (2 OF 4)

⦿ Data Portal

- All image data served by IMG, sorted by mission name
- Links to online data directories & Atlas for image selection
- Links to mission documentation
- <https://pds-imaging.jpl.nasa.gov/portal/>

⦿ Photojournal

- Press-release images, other quick-release “pretty pictures” from NASA missions
- Captions and variable image resolutions available
- <https://photojournal.jpl.nasa.gov/>

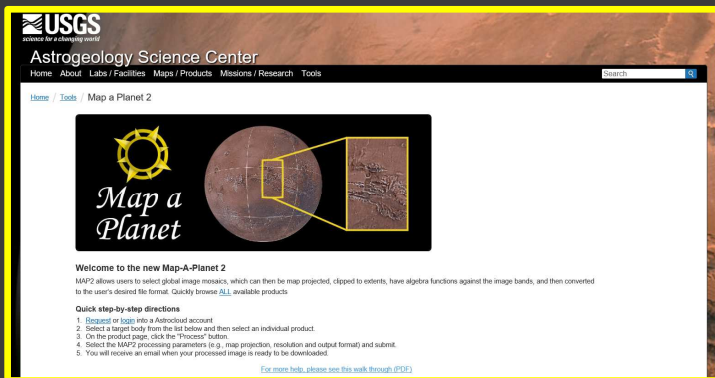


<https://pds-imaging.jpl.nasa.gov/>

IMG DATA DELIVERY SYSTEMS (3 OF 4)

● **Map-a-Planet (MAP)**

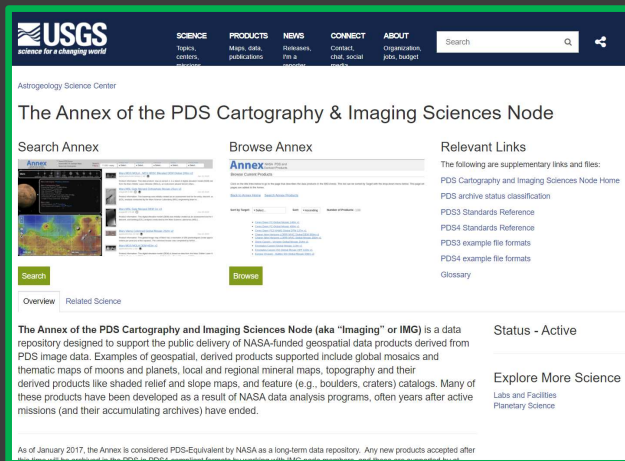
- Serves map-projected mosaics & derived data from PDS images
 - **158 products right now!**
- Basemaps for EDR searches at IMG and GEO
- Standardized Web Mapping Services (WMS) for ~all mapped bodies
- Supports cartographic extraction and some translation and/or reformatting of data products
- **Online tutorial:**
 - ftp://pdsimage2.wr.usgs.gov/pub/pigpen/tutorials/Map-a-Planet2_MAP2_Oct2015.pdf
- <https://astrogeology.usgs.gov/tools/map-a-planet-2>



<https://pds-imaging.jpl.nasa.gov/>

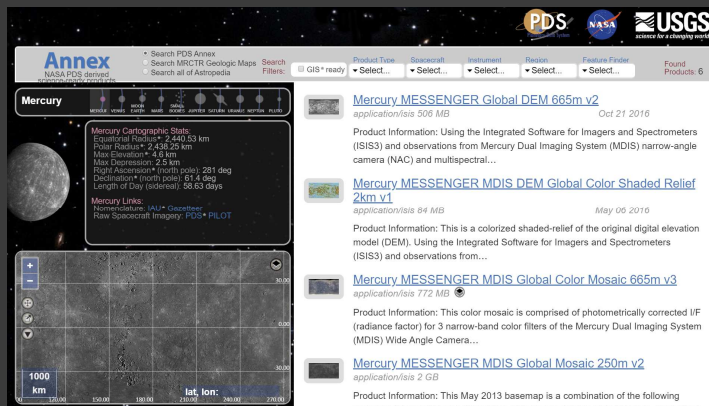


IMG DATA DELIVERY SYSTEMS (4 OF 4)



◎ The Annex of IMG

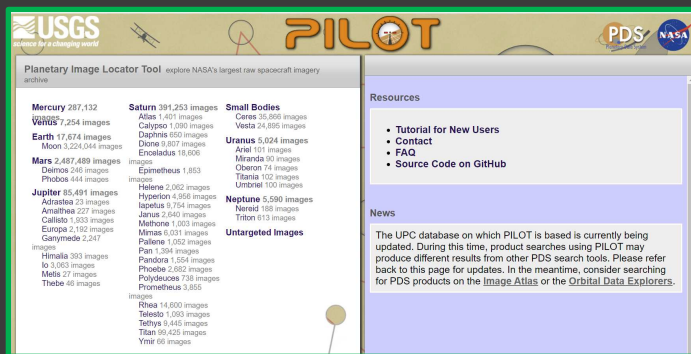
- Repository for NASA-funded geospatial products derived from PDS products
 - Mosaics, maps, shapefiles, tables
 - **108 products right now!**
- Map-based search or browse list
- Retains heritage to source data & metadata
- Links to publications, accuracy information, etc.
- **Online tutorial:**
 - https://prd-wret.s3-us-west-2.amazonaws.com/assets/palladium/producton/atoms/files/Annex_Tutorial_2020.pdf
- <https://www.usgs.gov/centers/astrogeology-science-center/science/annex-pds-cartography-imaging-sciences-node>



<https://pds-imaging.jpl.nasa.gov/>



IMG DATA PROCESSING SYSTEMS (1 OF 2)



Planetary Image Locator Tool (PILOT)

- Uses Unified Planetary Coordinates (UPC) database to standardize coordinates
- Supports PDS image data for which there is an ISIS3 camera model
 - Accurate, detailed surface placement
 - About 95% of IMG data holdings supported
- Geospatial and parameter search of PDS EDR image archives
- Ties to online POW processing tools
- **Online tutorial (thanks to Rose Borden!):**
 - https://pilot.wr.usgs.gov/doc/PILOT_Tutorial_Ig_12.1_6.19.pdf
- <https://pilot.wr.usgs.gov/>

<https://pds-imaging.jpl.nasa.gov/>



IMG DATA PROCESSING SYSTEMS (2 OF 2)



Projection on the Web (POW) Service

- From PILOT, users can send selected images straight to ISIS3 for processing on a compute cluster
- Runs ISIS3 cartographic software directly (*no need to download and run it!*)
- Pipeline data processing from raw to fully processed data products for up to 50 images (soon to be 200 images)
- **Online tutorial:**
 - ftp://pdsimage2.wr.usgs.gov/pub/pigpen/tutorials/Map_Projection_on_the_web_POW_March2013.pdf
- <https://astrocloud.wr.usgs.gov/>

<https://pds-imaging.jpl.nasa.gov/>



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IMG also works with **3 NASA (Mission) Data Nodes:**

- ◎ **Lunar Reconnaissance Orbiter (LRO) Cameras (LROC) (ASU)**
 - Serves a wide variety of LROC EDR, CDR, RDR products
 - Images, mosaics, derived products, maps, GIS shapefiles, etc.
 - About **1.1 PB** of data at present
 - <https://www.lroc.asu.edu/archive>
- ◎ **Mars Odyssey THEMIS (ASU)**
 - Search image directories, browse collections, analyze with JMARS
 - Numerous derived data products
 - About **30 TB** of data at present
 - <https://themis.asu.edu/>
- ◎ **Mars Reconnaissance Orbiter HiRISE (Univ AZ)**
 - Search image catalog, browse collections, view with HiView
 - Numerous derived data products
 - About **190 TB** of data at present
 - <https://hirise.lpl.arizona.edu/>

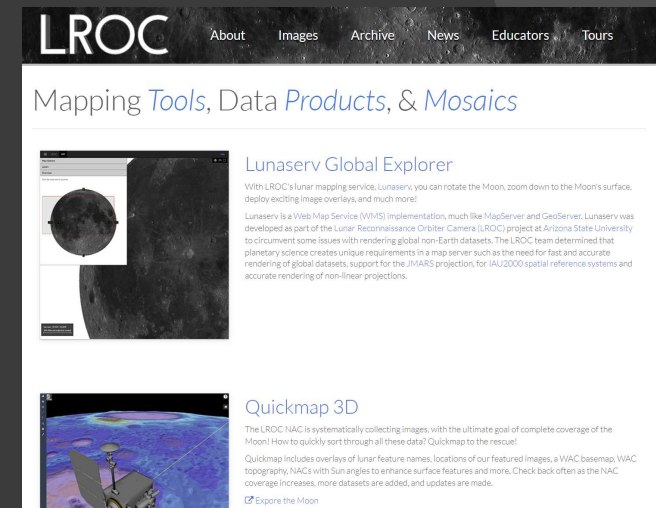
<https://pds-imaging.jpl.nasa.gov/>

IMG Data Nodes (1 of 3):

○ Lunar Reconnaissance Orbiter (LRO) Cameras (LROC)

- Serves a wide variety of LROC EDR, CDR, RDR products
 - Images, mosaics, derived products, maps, GIS shapefiles, etc.
 - About **1.1 PB** of data at present
- Several ways to search for products
 - WMS Map interface: <http://wms.lroc.asu.edu/lroc>
 - QuickMap 3D viewer: <https://quickmap.lroc.asu.edu/>
 - Thumbnail browser: <http://wms.lroc.asu.edu/lroc/thumbnails>
 - Metadata search: <http://wms.lroc.asu.edu/lroc/search>
 - RDR (mosaics, maps) products: http://wms.lroc.asu.edu/lroc/rdr_product_select
- <https://www.lroc.asu.edu/archive>

<https://pds-imaging.jpl.nasa.gov/>



LROC About Images Archive News Educators Tours

Mapping *Tools*, Data *Products*, & *Mosaics*

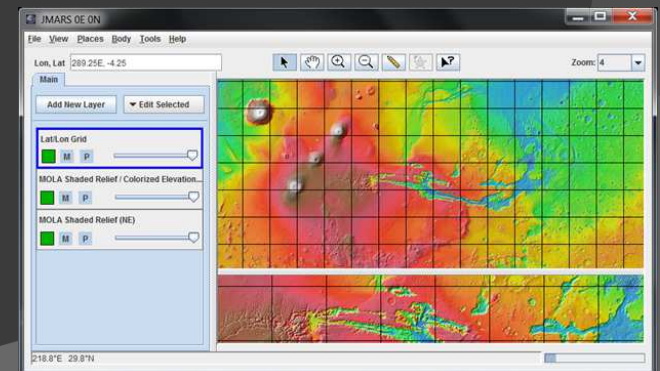
Lunaserv Global Explorer
 With LROC's lunar mapping service, Lunaserv, you can rotate the Moon, zoom down to the Moon's surface, display exciting image overlays, and much more!
 Lunaserv is a Web Map Service (WMS) implementation, much like MapServer and GeoServer. Lunaserv was developed as part of the Lunar Reconnaissance Orbiter Camera (LROC) project at Arizona State University to circumvent some issues with rendering global non-Earth datasets. The LROC team determined that planetary science creates unique requirements in a map server such as the need for fast and accurate rendering of global datasets, support for the JMAPS projection, for IAU2000 spatial reference systems and accurate rendering of non-linear projections.

Quickmap 3D
 The LROC NAC is systematically collecting images, with the ultimate goal of complete coverage of the Moon! How to quickly sort through all these data? Quickmap to the rescue!
 Quickmap includes overlays of lunar feature names, locations of our featured images, a WAC basemap, WAC topography, NACs with Sun angles to enhance surface features and more. Check back often as the NAC coverage increases, more datasets are added, and updates are made.
 ☑ Explore the Moon



IMG Data Nodes (2 of 3):

- **Mars Odyssey THEMIS (ASU)**
 - Numerous data and derived data products
 - THEMIS, CTX, HRSC, HiRISE, MOC, Viking coverages
 - Several ways to find data:
 - Search based on metadata: <http://viewer.mars.asu.edu/viewer/themis#T=0>
 - Interactive maps: <https://themis.asu.edu/maps>
 - Analyze and view data with JMARS:
 - <https://jmars.mars.asu.edu/>
 - About **30 TB** of data at present
 - <https://themis.asu.edu/>

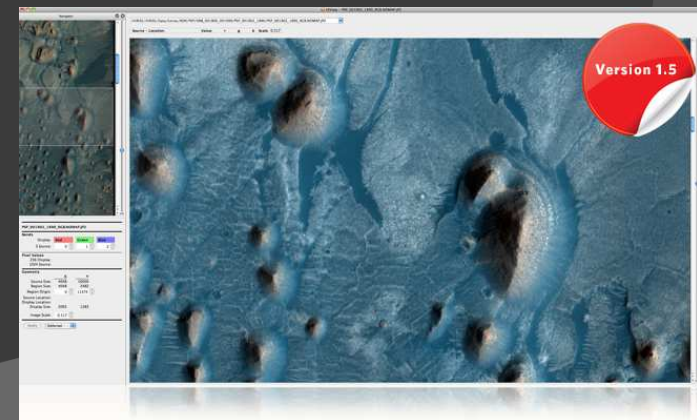
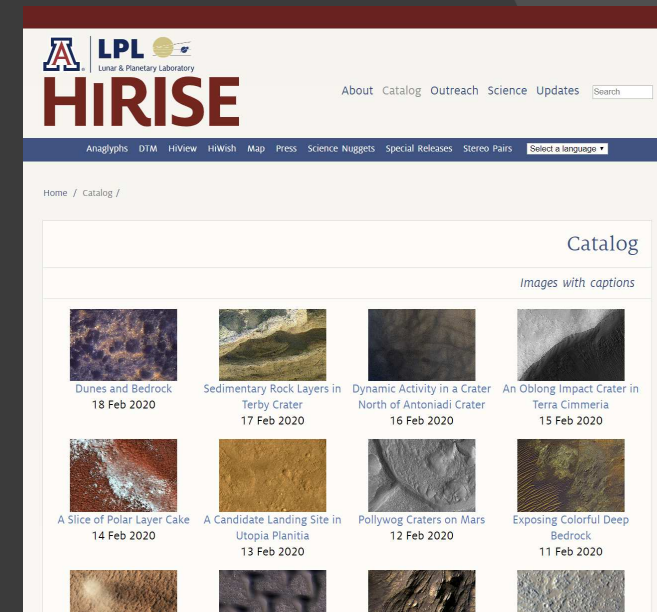


<https://pds-imaging.jpl.nasa.gov/>

IMG Data Nodes (3 of 3):

● MRO HiRISE (Univ AZ)

- Search image directories, browse catalog
- Numerous derived data products (anaglyphs, DTMs, mosaics) and press-release images
- Map-based search
- Analyze and view data with HiView:
 - <https://pirlwww.lpl.arizona.edu/software/registration/registration.cgi?software=HiView>
- About **190 TB** of data at present
- <https://hirise.lpl.arizona.edu/>



<https://pds-imaging.jpl.nasa.gov/>



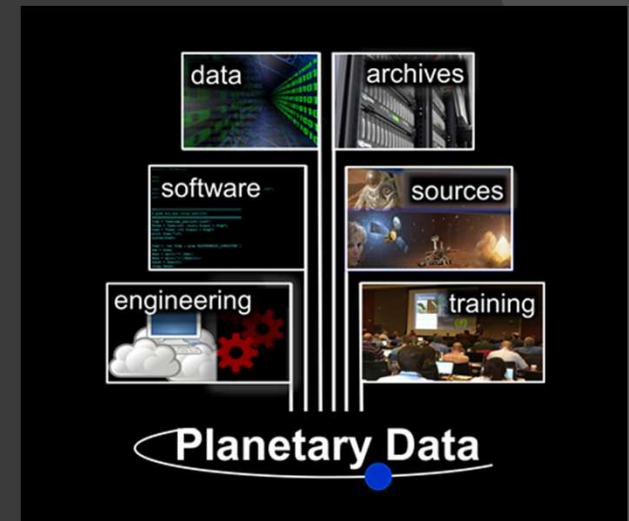
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<https://pds-imaging.jpl.nasa.gov/>