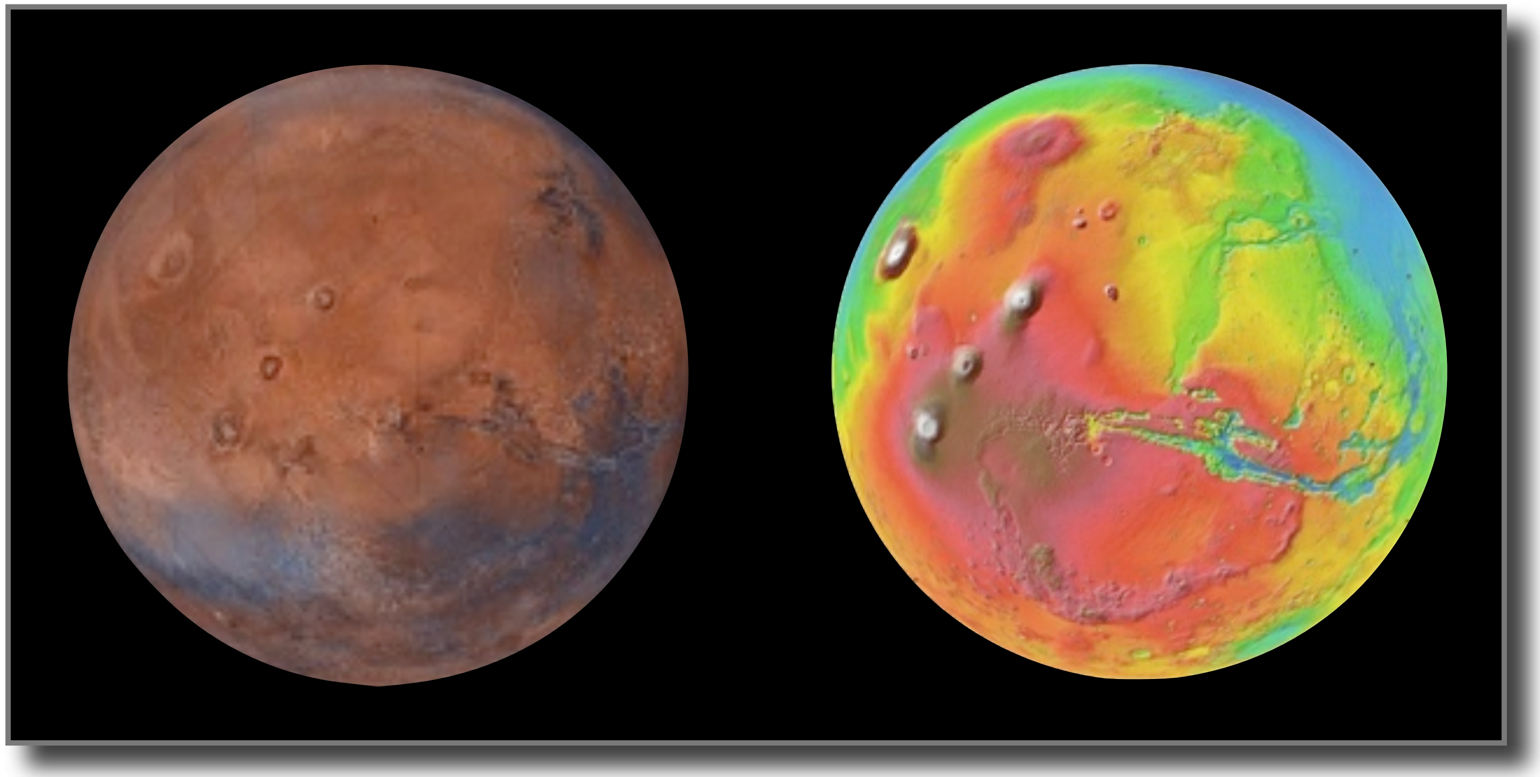
WorldWide Telescope Mars

Another Geo Browser Platform for Science and Outreach



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NASA Ames Planetary Mapping Team

Making NASA's data more universally and easily accessible on-line.

We are members of the Intelligent Robotics Group (IRG), part of the Intelligent Systems Division (Code TI) at NASA Ames Research Center.

We work extremely closely with Ames Code I (IT & Nebula Cloud Computing) and Code TN (supercomputing).

The "Mapmakers" are a team within IRG consisting of Roboticists, Web Developers, Software Engineers, Vision Researchers, and (one) Planetary Scientist.

Some of our Projects

Automated 3D surface reconstruction, and gigapixel imaging.

- Bridging the gap between PDS and Geo-browser platforms.*

  This is the subject of today's talk...

- Developers in the Lunar Mapping and Modeling Program (LMMP)*

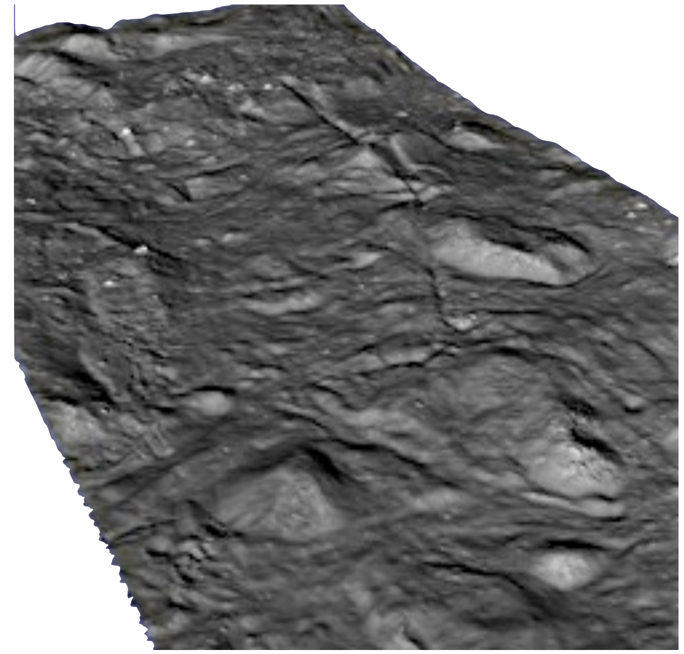
  Providing stereo-derived topography and imagery from Apollo Metric Camera scans.

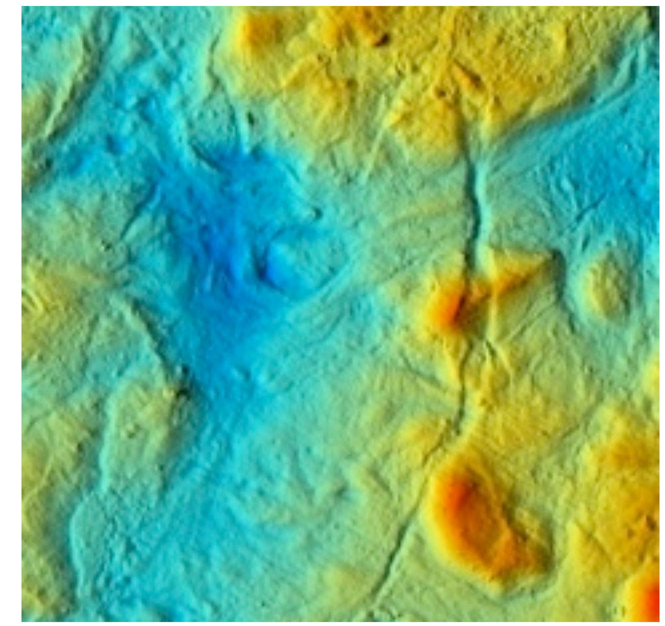
- LROC & HiRISE Team Collaboration

  Validating and estimating the errors of LROC-derived DTMs

- Assorted other projects:

  Disaster response imaging, Gigapan gigapixel imaging, and robotic field tests.





Fully Automated Stereo Reconstruction of Jackson Crater from LROC-NAC imagery

1.47 Gigapixel Panorama of Obama's Inauguration
http://gigapan.org

*These activities grew from a grant of funding for 3D stereo mapping provided by the NASA AISR program.

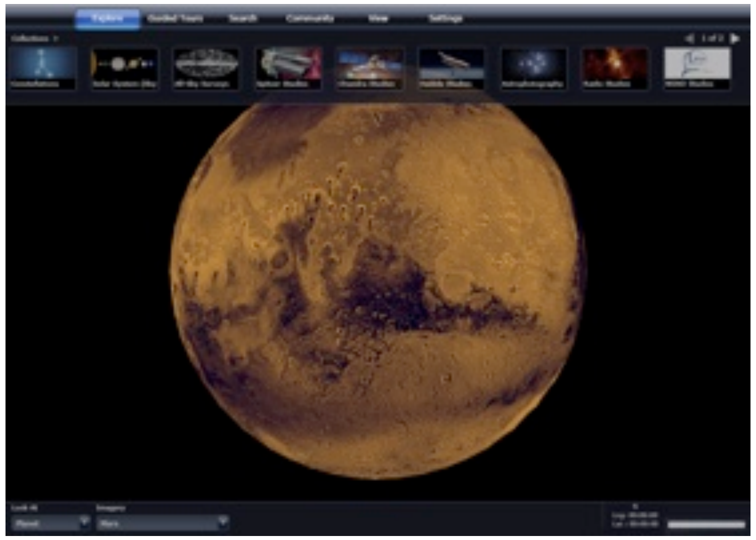
Providing “Live” Planetary Data Access

Providing 2D and 3D NASA imagery to cutting-edge geo-browser platforms

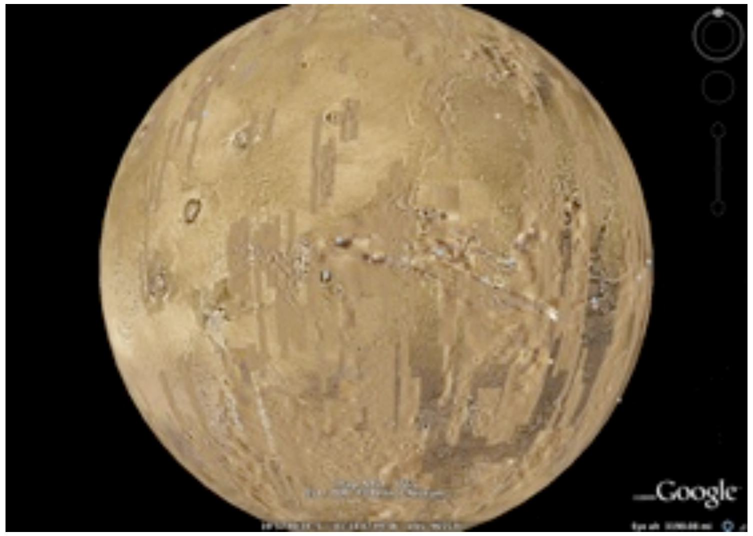
- NASA has done an exemplary job of archiving its data and making it publicly available (e.g. the PDS and DAACs), but these archives were not designed for immediate, on-demand access to the data.

- We believe that there is a need to bridge the gap between the PDS and users who are not “data experts.”

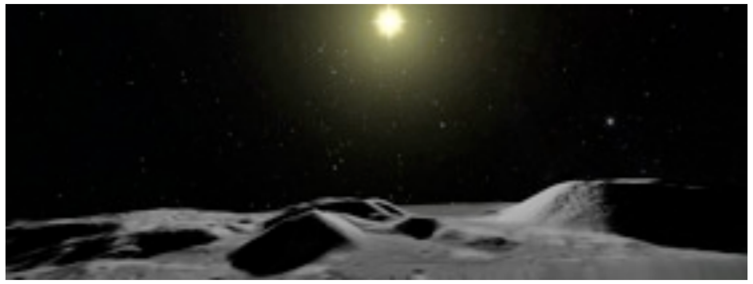
- Ubiquitous, freely available geo-browser platforms are technologically well-suited to this task, and a natural fit to fill this gap.



Microsoft WorldWide Telescope



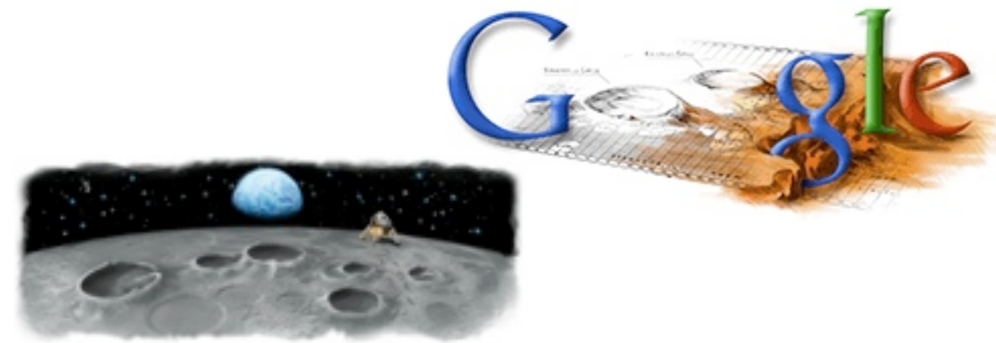
Moon and Mars mode for Google Earth



Lunar Imagery for Uniview

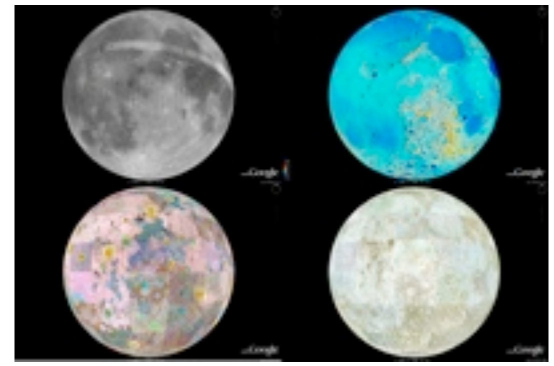
NASA / Google

Explore the Moon and Mars in 3D

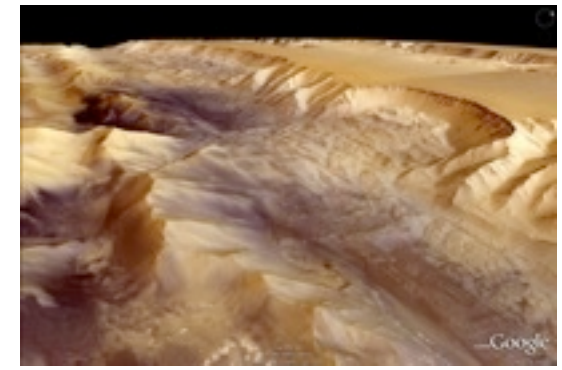


- Google Moon & Mars provide data availability & fusion for planetary data.
- Includes "live" imagery of Mars from the THEMIS camera.
- Guided tours of the Moon and Mars narrated by Buzz Aldrin, Jack Schmitt, Ira Flatow, and Bill Nye.

Try it for yourself in Google Earth 5.0!

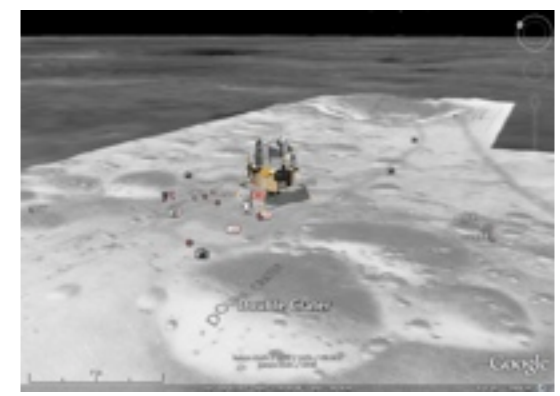


Modern / Historical Base Maps



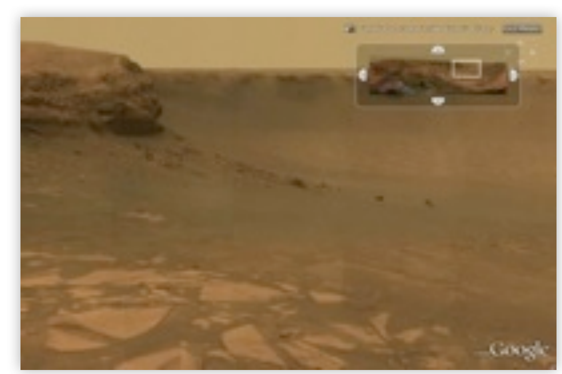
High Resolution 3D Terrain

Geospatial Image Browsing/Indexing



Tours Narrated by Notable Scientists and Astronauts

Geologic Maps

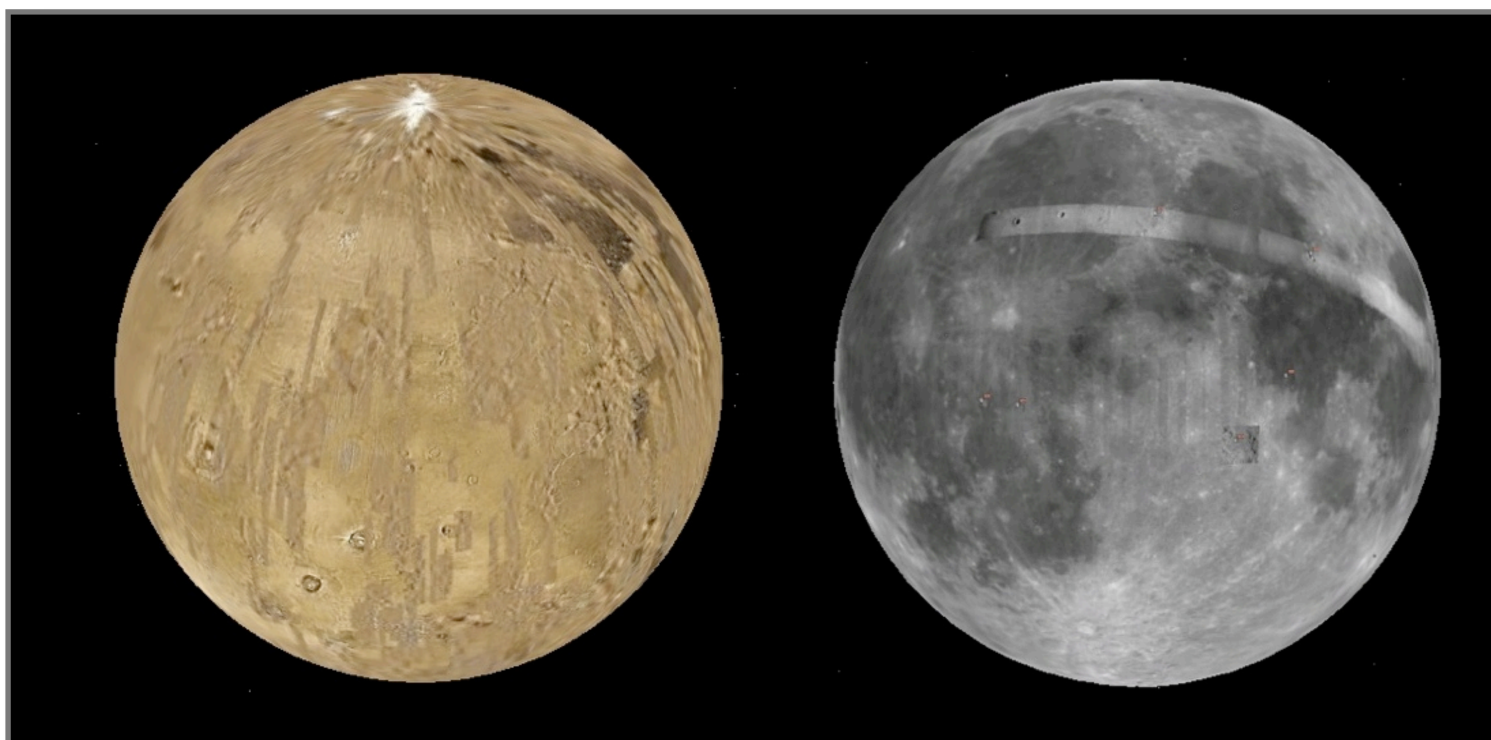


Geo-located Panoramic Imagery

This work was done at ARC under a reimbursible space act agreement (RSAA).
The RSAA does *not* imply exclusive access to NASA data or to our team.

Google Mars & Moon Demo

Base layers, terrain, and high resolution imagery



NASA / Microsoft

Bringing the Mars experience to WorldWide Telescope

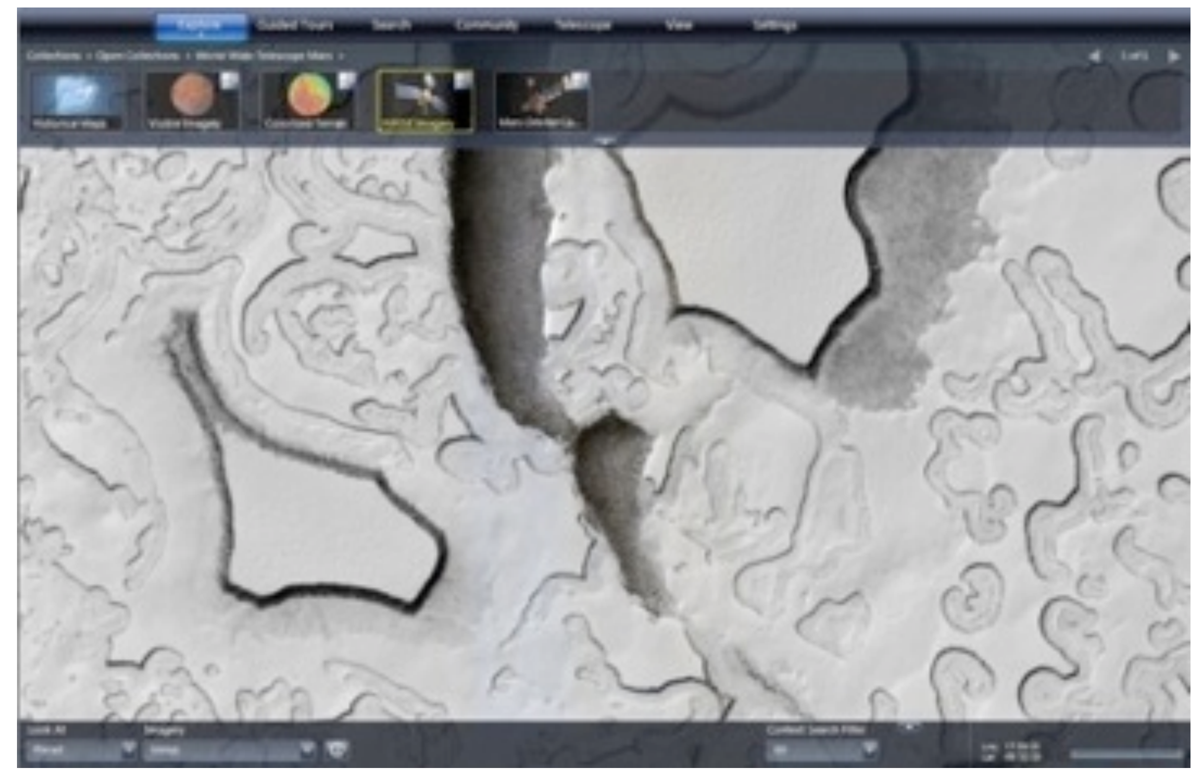
WWT | Mars

- Featuring the largest digital image mosaic of Mars ever created: 13,000 HiRISE images.
- Data sets for WWT Mars are being served off of NASA's hardware for the first time using the Nebula cloud computing platform.

NEBULA Cloud Computing Platform alpha

- Guided tours of Mars narrated by Dr. Carol Stoker and Dr. Jim Garvin

http://worldwidetelescope.org



HiRISE Mosaic Statistics:

- 526 Million image tiles
- 15-TB of compressed data
- Processing took 14 days on 114 Nebula CPUs

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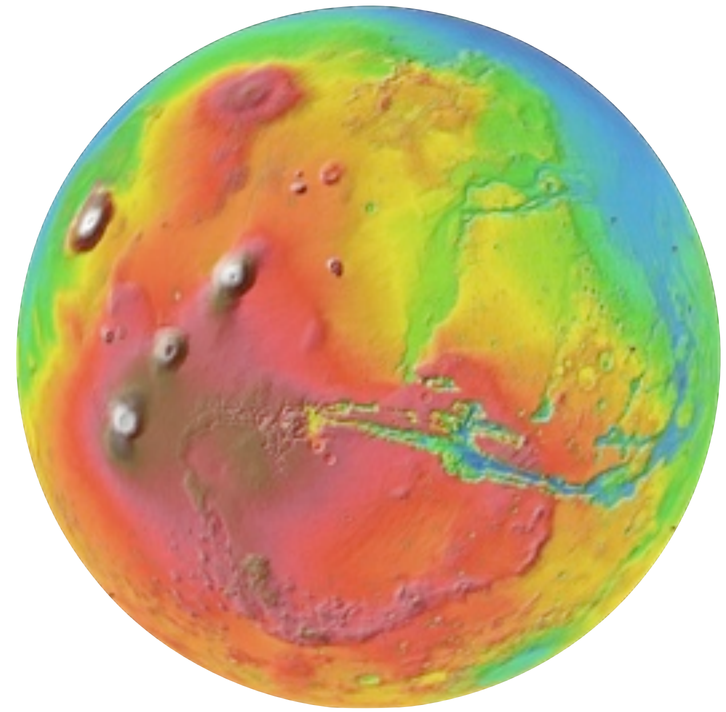
WWT Mars Base Layers

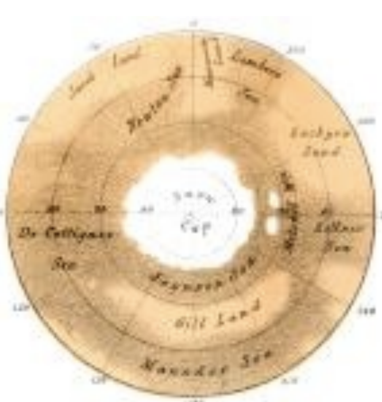
Global Imagery

Color MDIM v2 (merged w/ MOC-WAC mosaic)

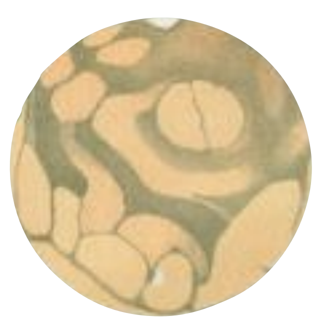


Mars Topography (MOLA)

Historical Imagery

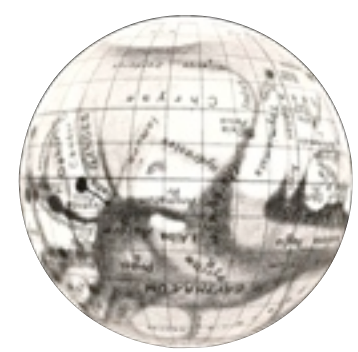


Nathaniel Green (1877)

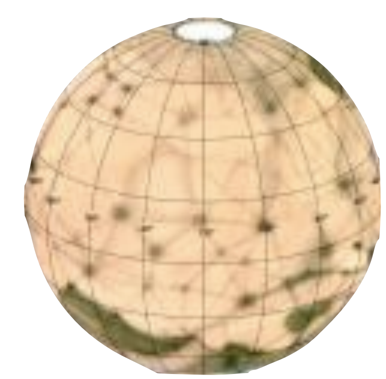


Giovanni Schiaparelli (1890)

Percival Lowell (1896)



Eugene Antoniadi (1909)

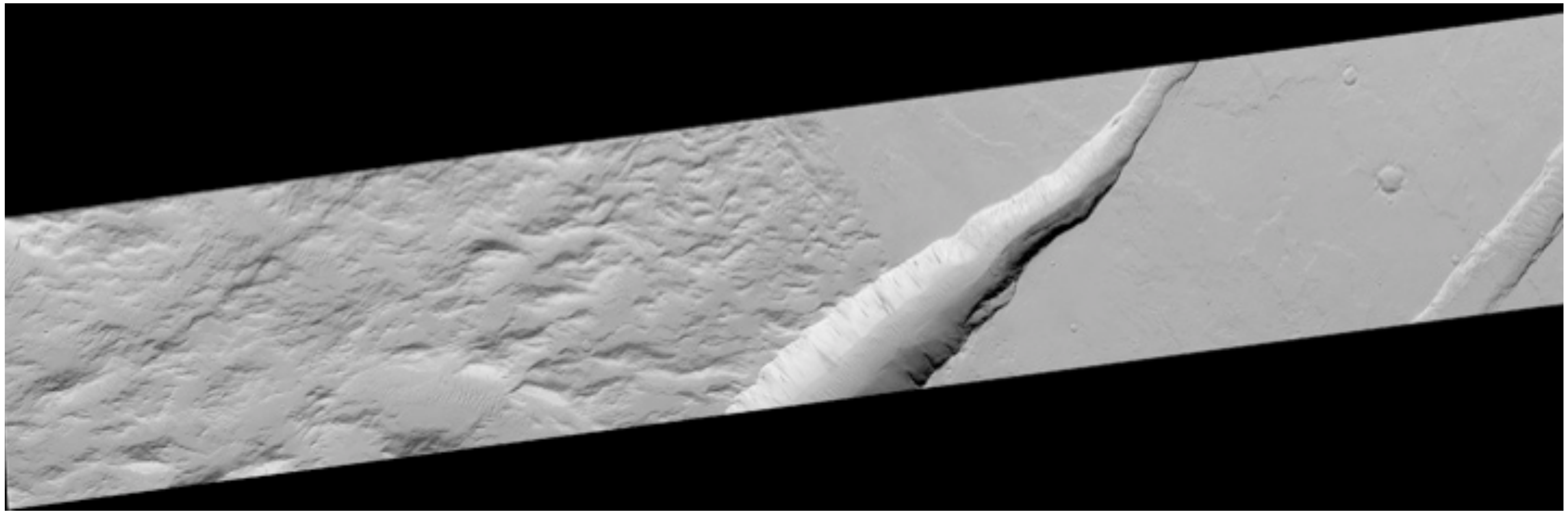


MEC-1 Prototype (USAF) (1962)

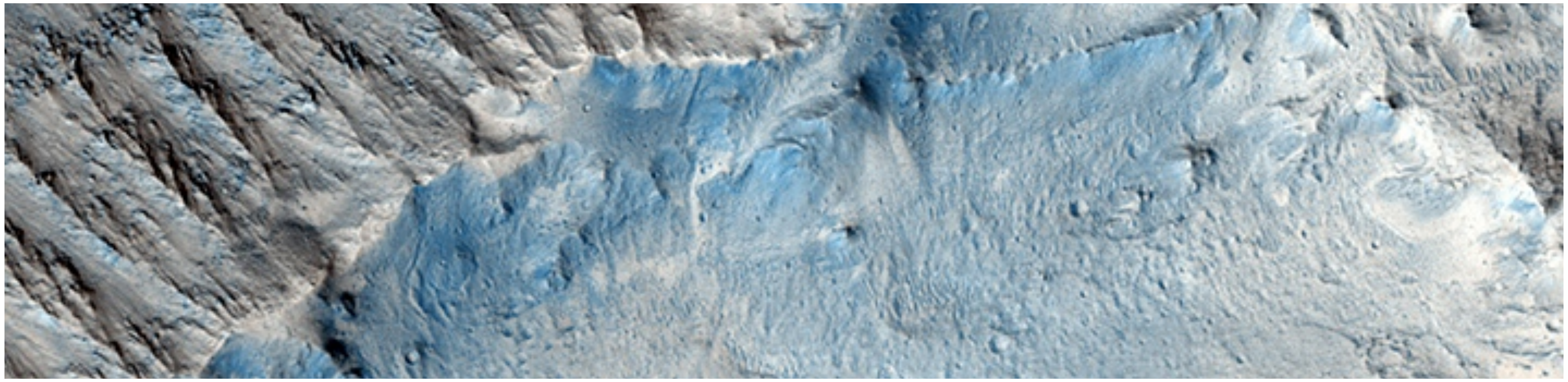
WWT High Resolution Layers

From Mars Global Surveyor and Mars Reconnaissance Orbiter

- 74,359 Mars Global Surveyor MOC Images

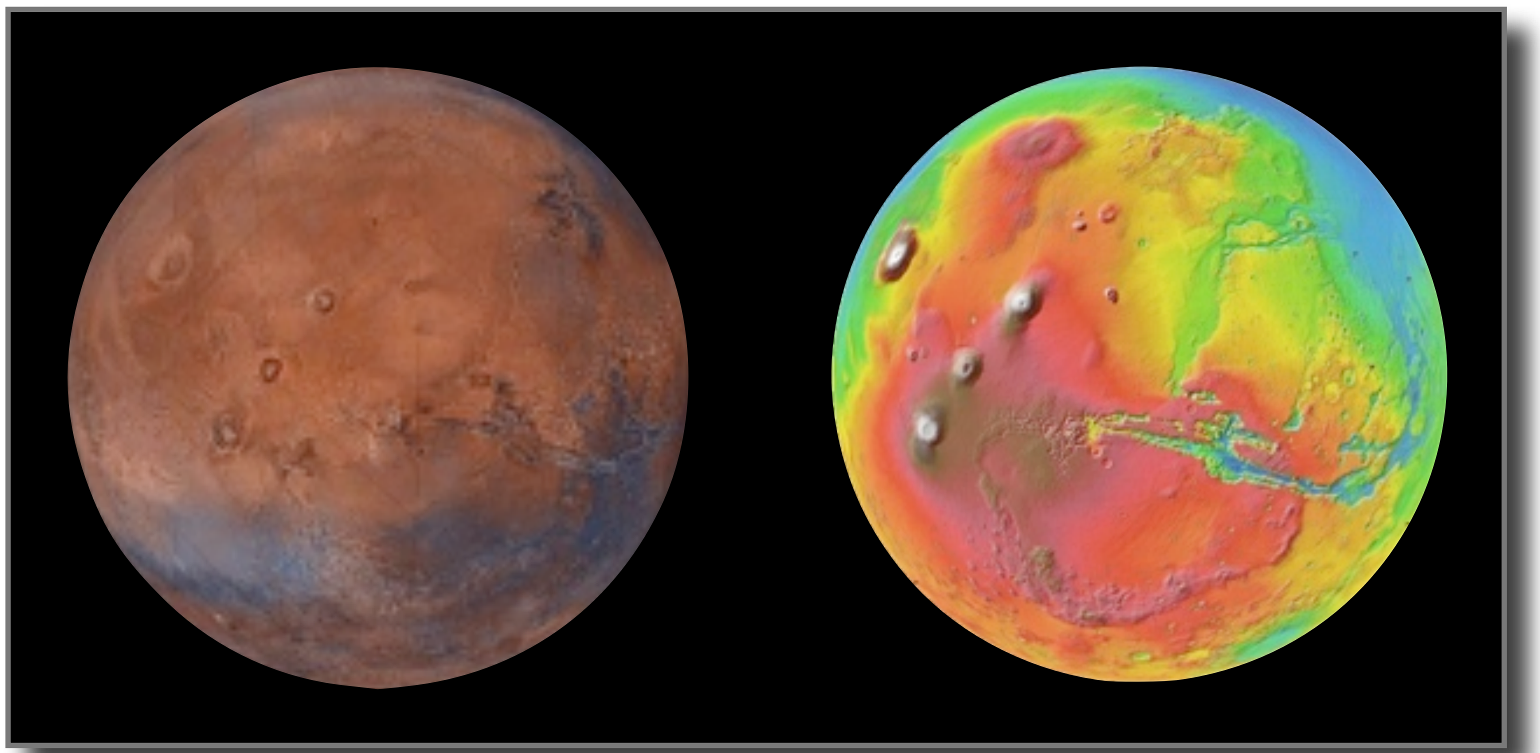


- 13,342 Mars Reconnaissance Orbiter HiRISE Observations



WorldWide Telescope Demo

Base layers, terrain, and high resolution imagery



High Resolution WWT Mosaics

Some notable statistics...

Input Images:

	MOC	HiRISE
Total # of images	**74,359**	**13,342**
Pixels / Image	16 Megapixels	1.25 Gigapixels

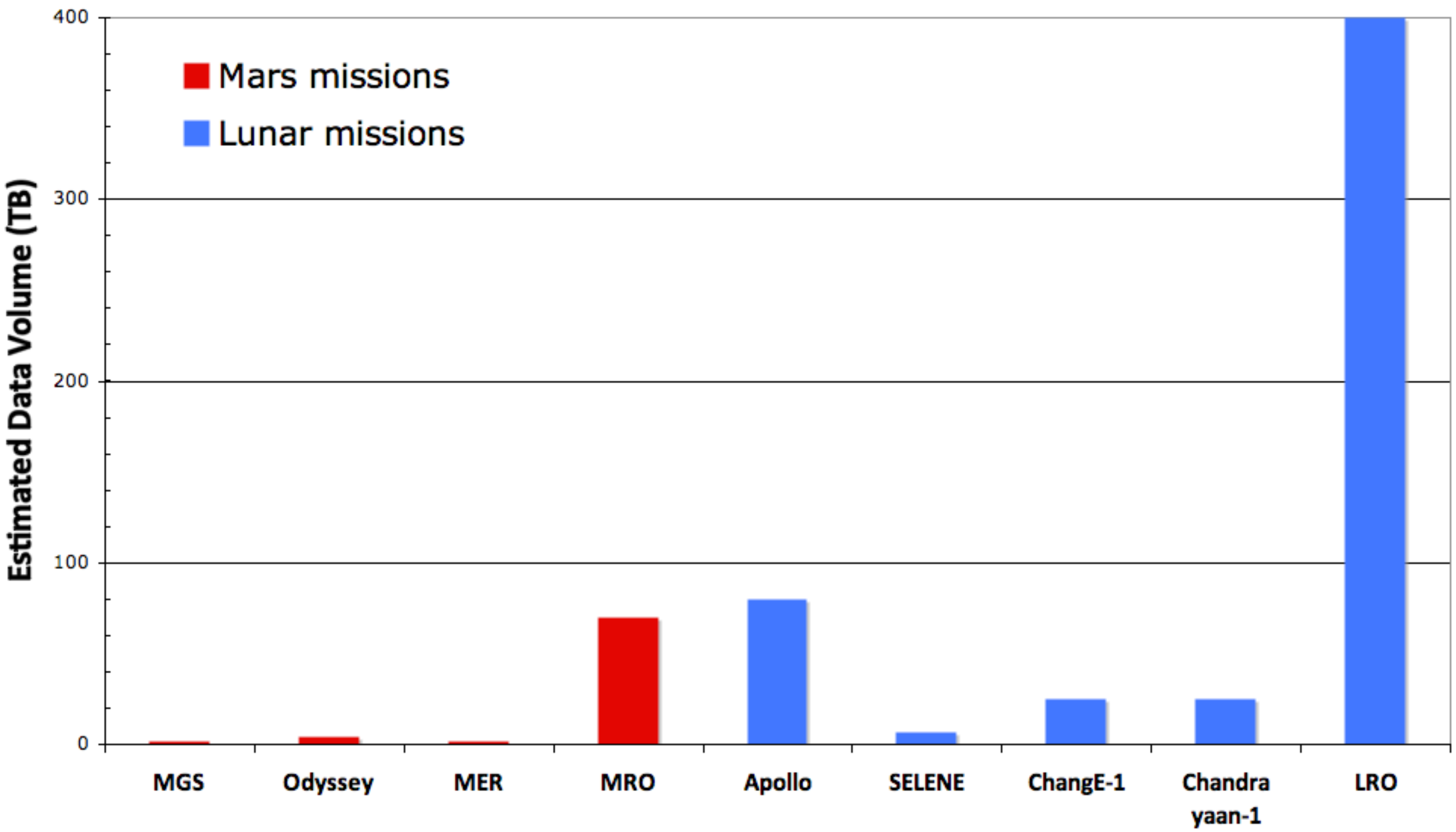
Output Mosaic:

	MOC	HiRISE
Total # of image tiles	~38 Million	~526 Million
Total Mosaic Size	**843 Gigabytes**	**12 Terabytes**

Managing the Data

Why do we need to build systems to handle large volumes of Planetary data?

We are in the midst of a major geospatial information explosion. For the first time, 10's of Terabytes of map data are being collected by robotic explorers.



Approximate data volumes from various Mars (red) and Lunar (blue) missions.

Data volumes are in Terabytes!

Source: B. A. Archinal, L. R. Gaddis, R. L. Kirk, T. M. Hare, and M. R. Rosiek. Urgent Processing and Geodetic Control of Lunar Data. Workshop on Science Associated with the Lunar Exploration Architecture, 2007.

Managing the Data

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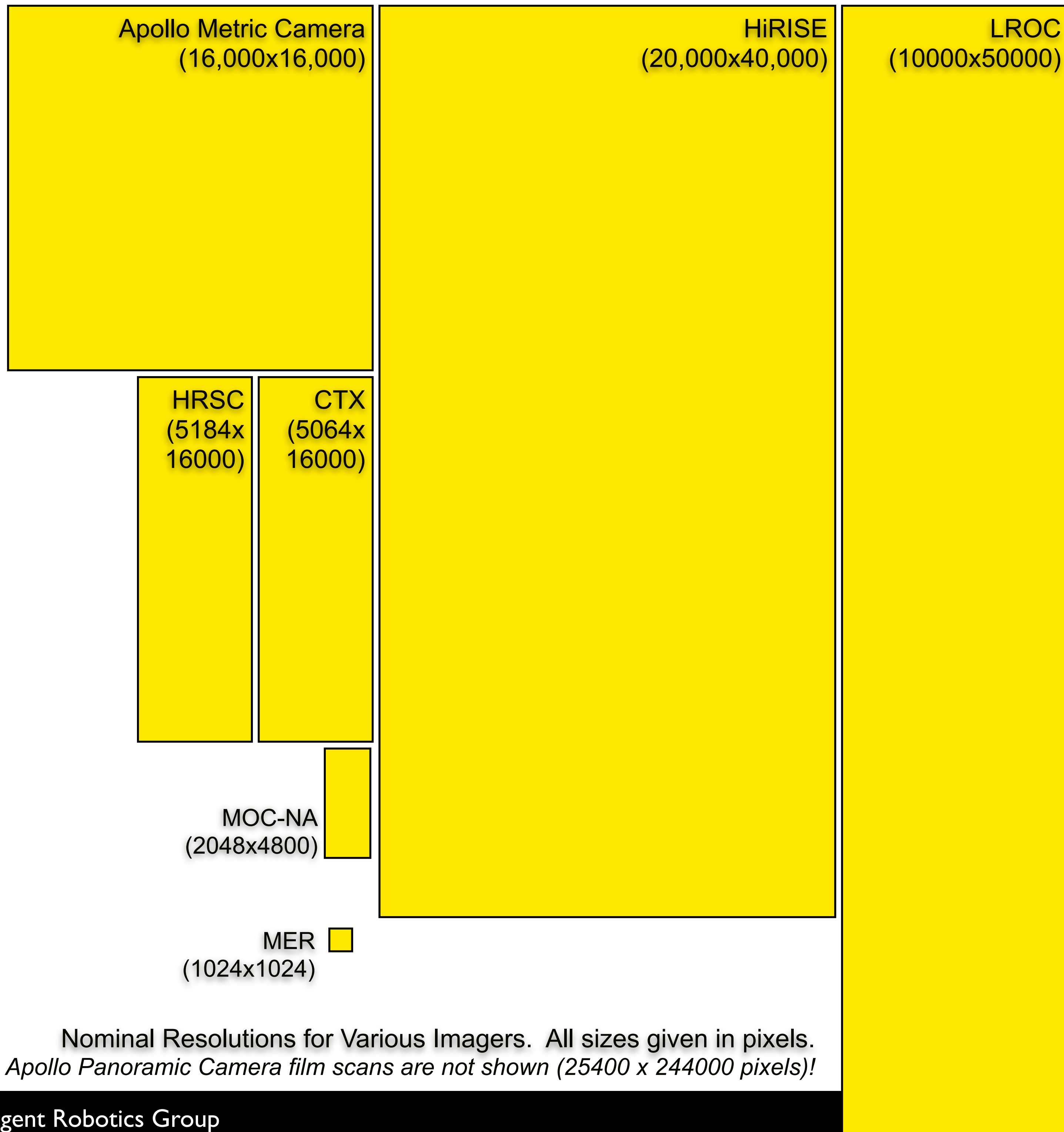


Nominal Resolutions for Various Imagers. All sizes given in pixels.
Apollo Panoramic Camera film scans are not shown (25400 x 244000 pixels)!

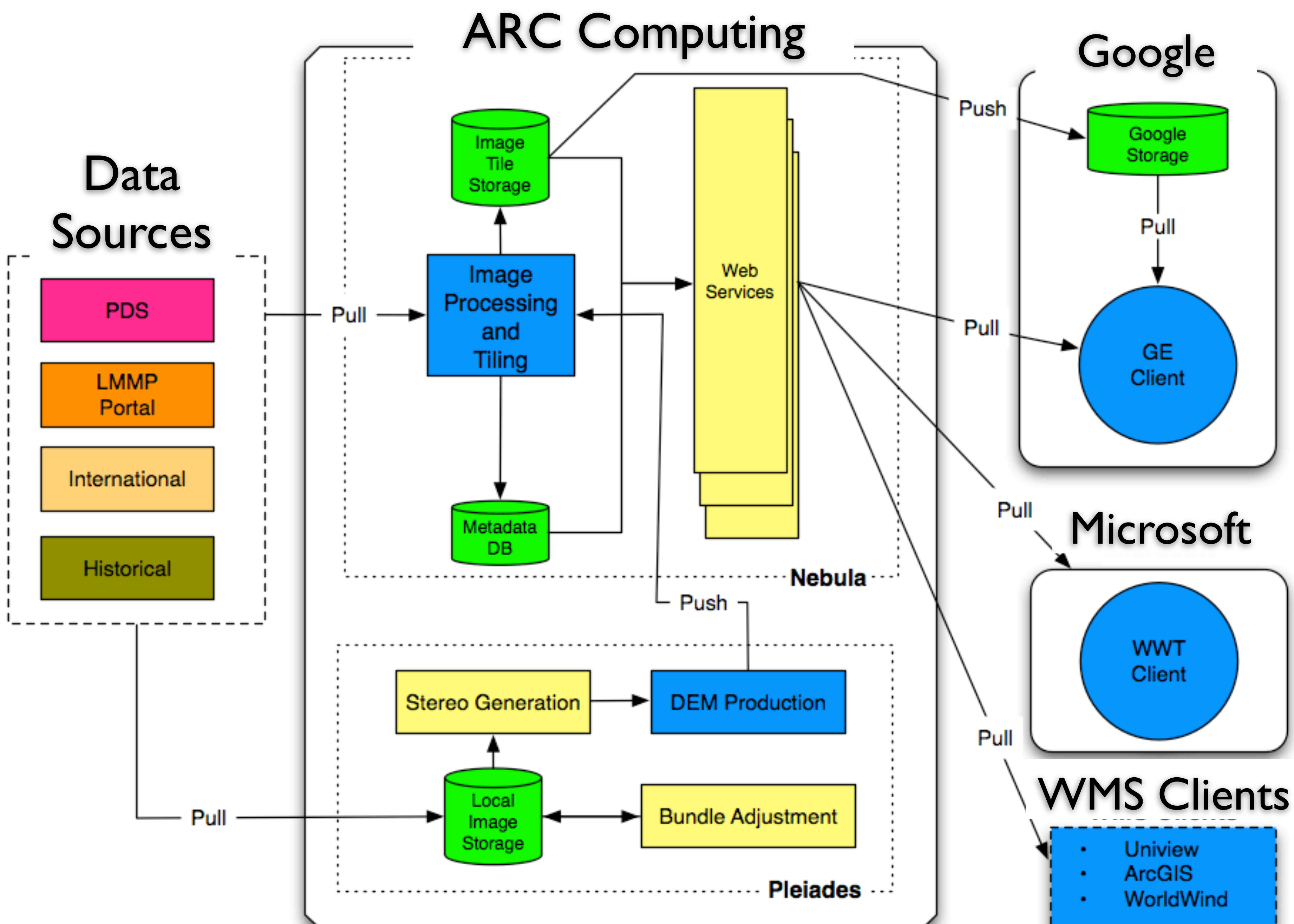
- In the past, widely used maps such as the Viking MDIM mosaic took years to produce.

- Today, human intensive processes can be automated so that data can be processed & served up much more efficiently.

Our Automated Pipeline

A single, unified architecture for processing & serving planetary data through web services.

- Our geospatial data pipeline has been developed to facilitate the Microsoft/Google work.
- It is extremely flexible & extensible, supporting many data source and open standards & protocols.
- Our software stack runs on Nebula, the NASA cloud computing platform, which makes it extremely scalable.



An Open Question

Where do we go from here?

How can we (NASA) leverage, amplify, and build on these platforms?

- *Can we achieve near real-time release of planetary data, and serve up a continuously updated, "live" mosaic of Mars to our scientists?*
- *Can we craft a communications strategy that leverages the strength of these platforms to syndicate imagery, analysis, annotations, and discussion from active missions?*
- *Can we simultaneously publish NASA planetary data to all major geo-browser and GIS platforms, so that it becomes immediately available (and useful) to a broad variety of users, not just data "experts"?*

Our Partners