



*Science and Problems of the XXI Century*

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**Global Mapping of Mars:  
A Historical Perspective  
(One Less Problem)**

by

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**presented at the**

**Russian Academy of Sciences  
Institute of Space Research IKI  
Conference Hall  
Moscow, Russia  
10:50 am  
02 October 2007**



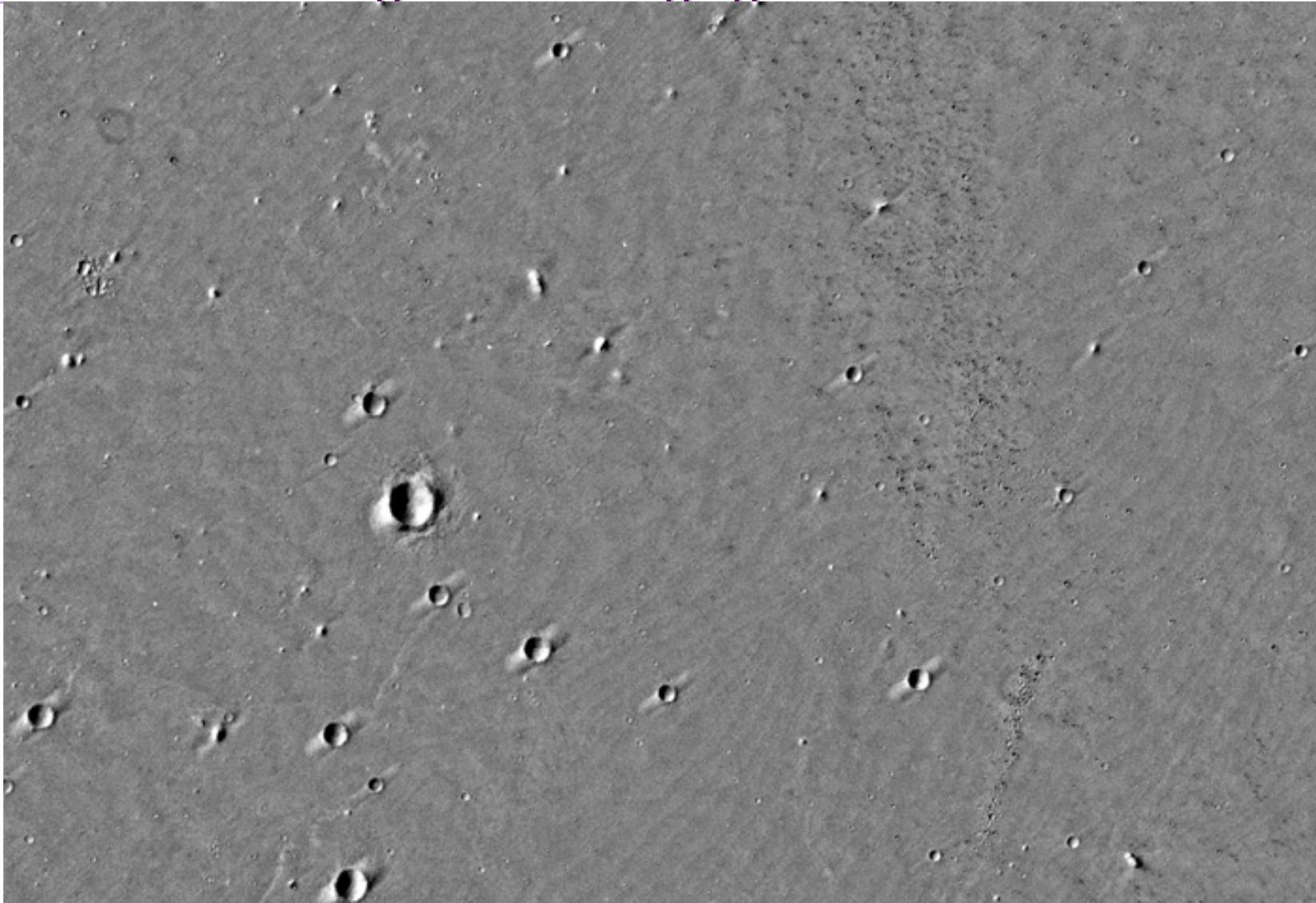
# *MARS LANDING SITES AND GLOBAL CARTOGRAPHY*

- **The ability to produce precision cartographic products for landing sites needed to assess / select sites and then support mission operations for targeting the landing and roving operations has improved by orders of magnitude since Viking in 1976**
  - **Inaccurate gravity field yielded inaccurate orbits > a few km**
  - **Older star trackers gave inaccurate pointing knowledge and control leading to errors on the ground > a few km**
  - **No absolute control for control network ties to inertial space > a few km**
  - **Cameras used vidicons having low metric accuracies - 10's to 100's of meters**
  - **Large errors in spin axis, spin rate and location of prime meridian > a few km**

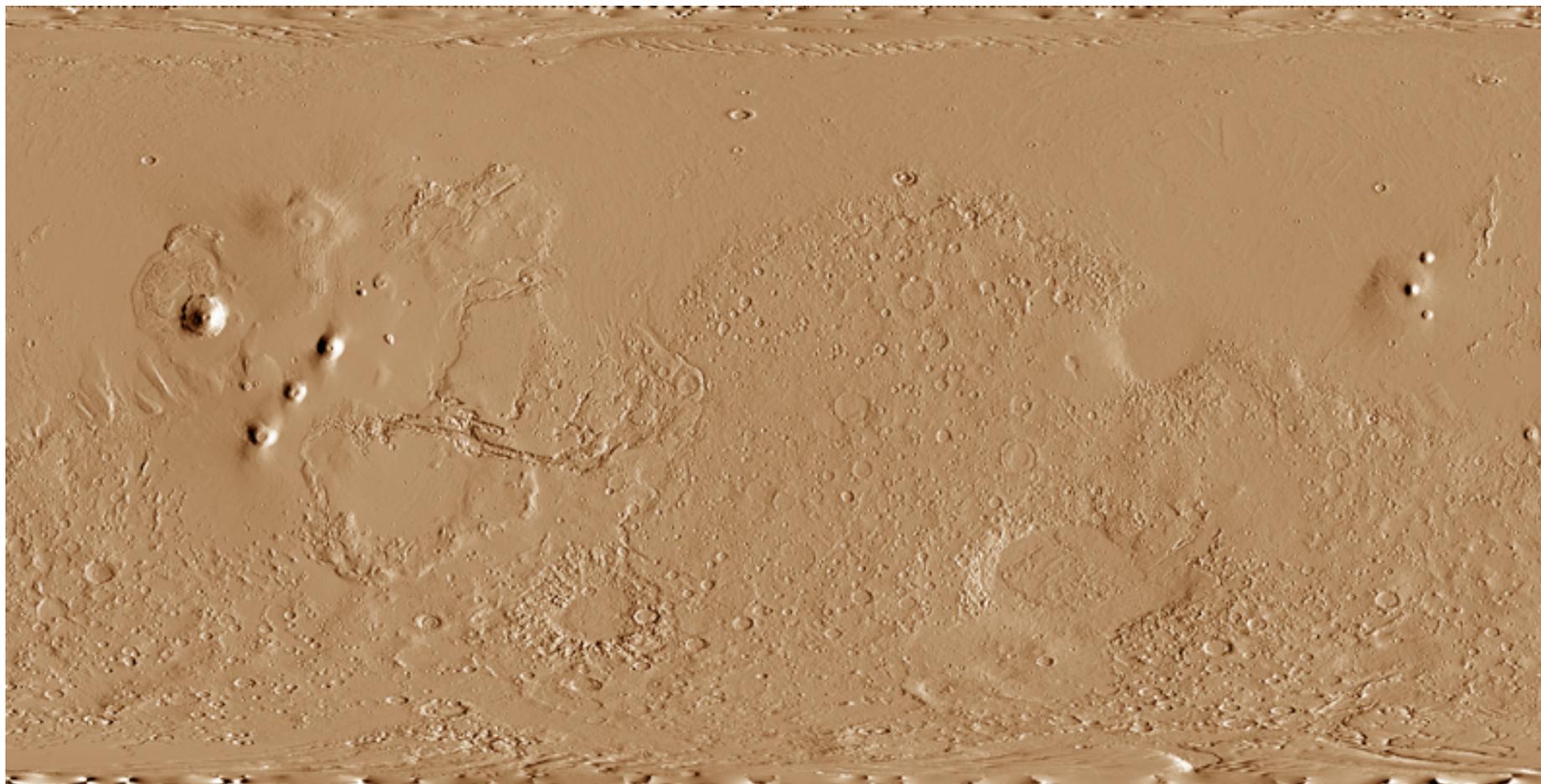


# *Mars Pathfinder - Classic Stereo Photogrammetry*

## *Viking Orbiter Imaging - no MGS MOLA*



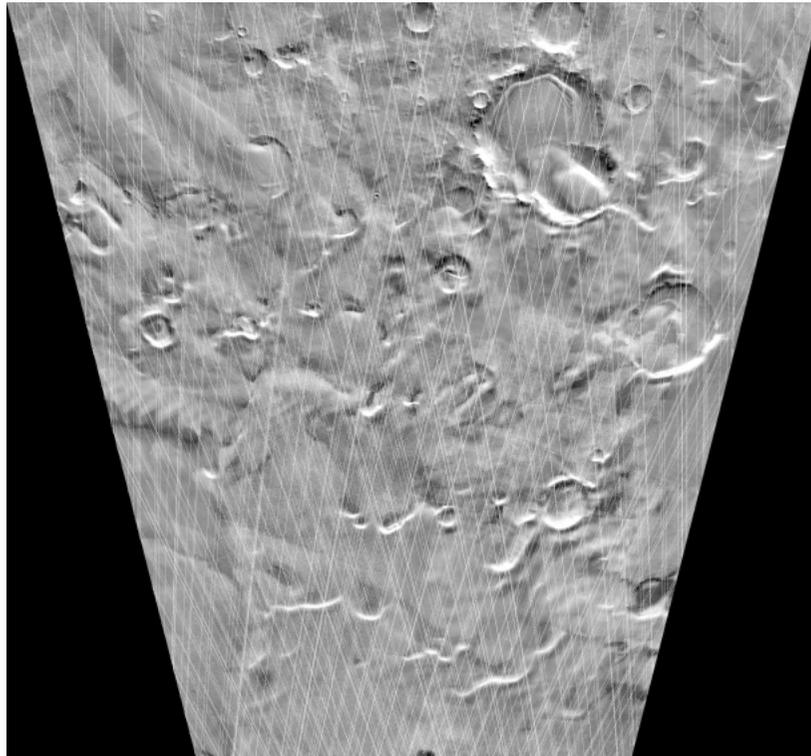
# *MGS GLOBAL MOLA DTM*



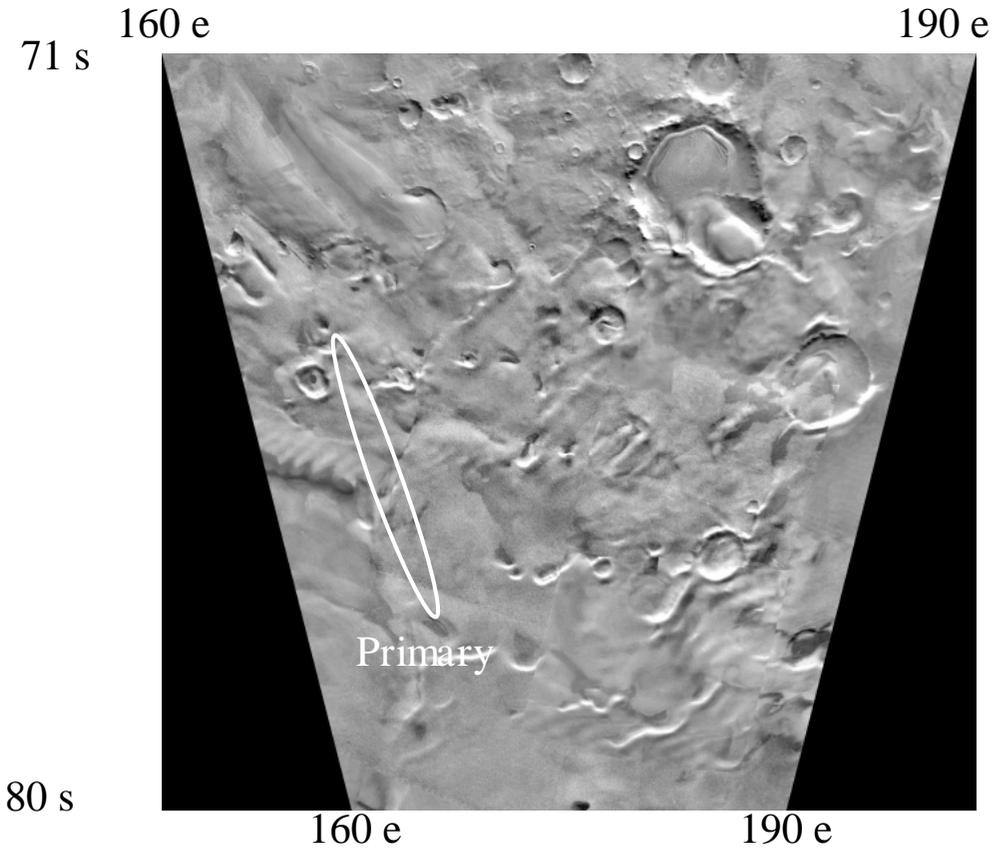
NASA / JPL / MGS / MOLA / GSFC / D. Smith - PI  
<http://pds-geosciences.wustl.edu/missions/mgs/mola.html>



## Mars Polar Lander - First Use of MOLA Control



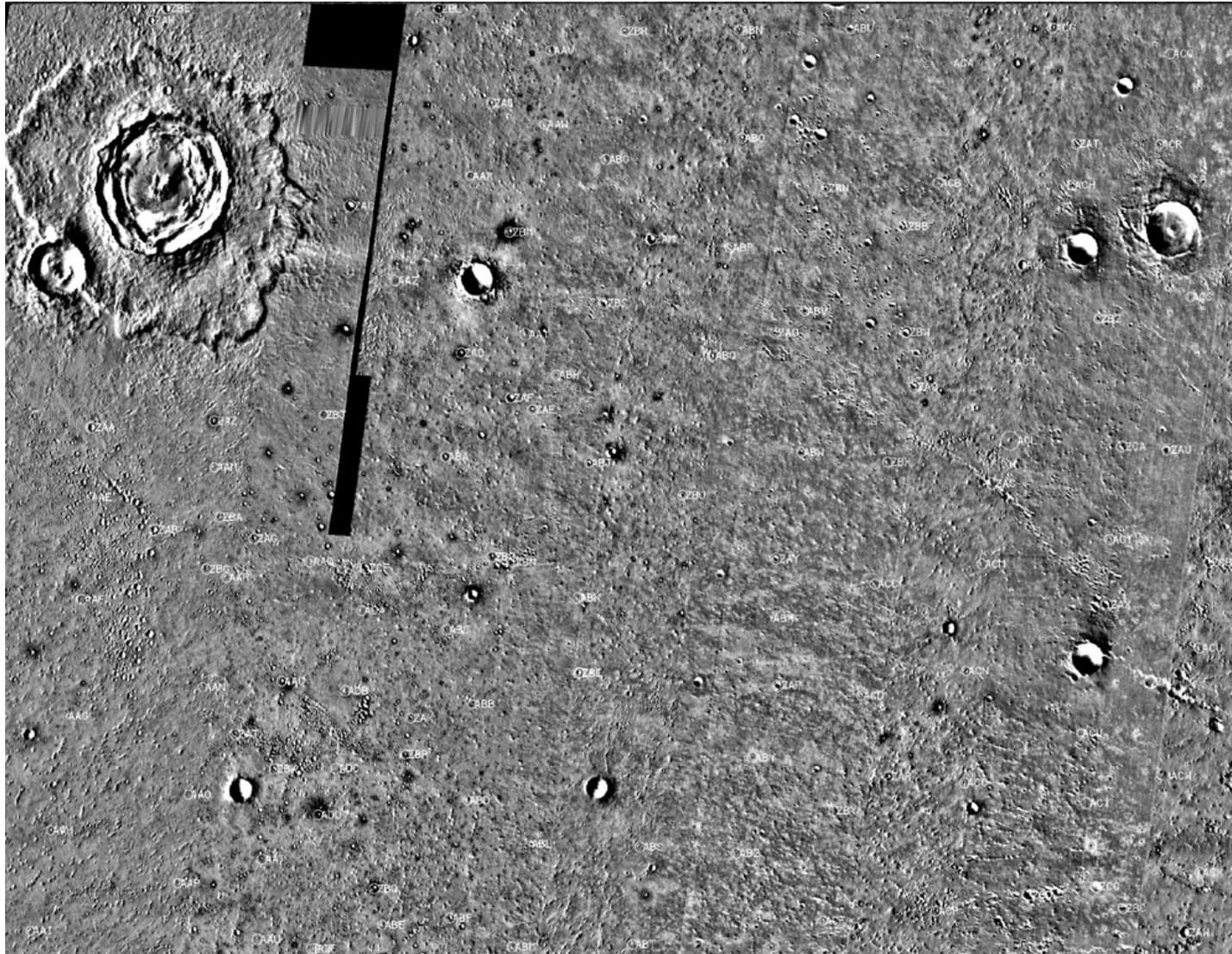
300 MOLA Ground Tracks through June 1999  
in MPL Site giving > 400,000 Altimetry Points





# *Beagle 2 in ISIDIS*

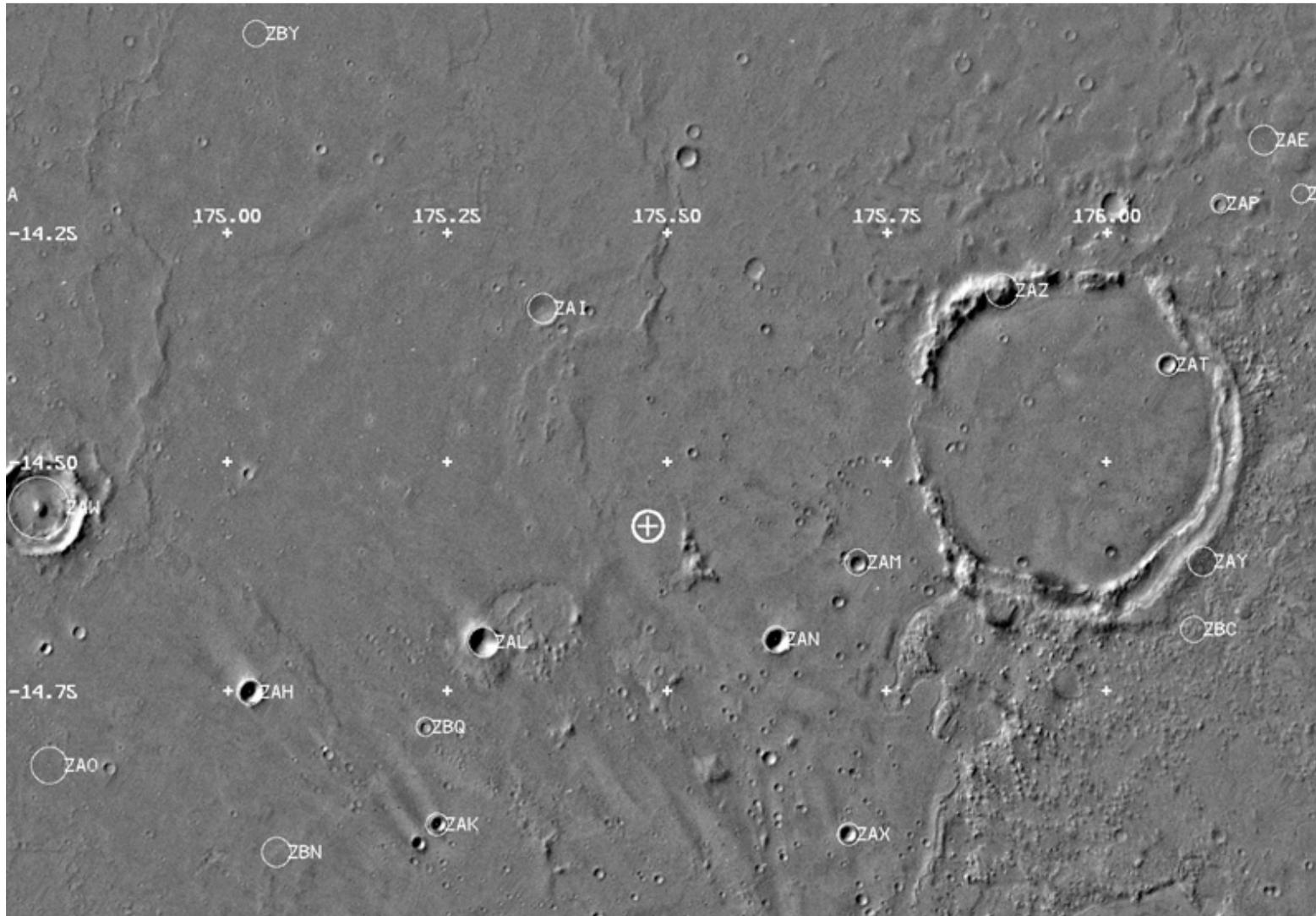
## *ODYSSEY THEMIS IR / MGS MOLA*





# *MER A Spirit in Gusev Crater*

## *Viking Orbiter Imaging / MGS MOLA*

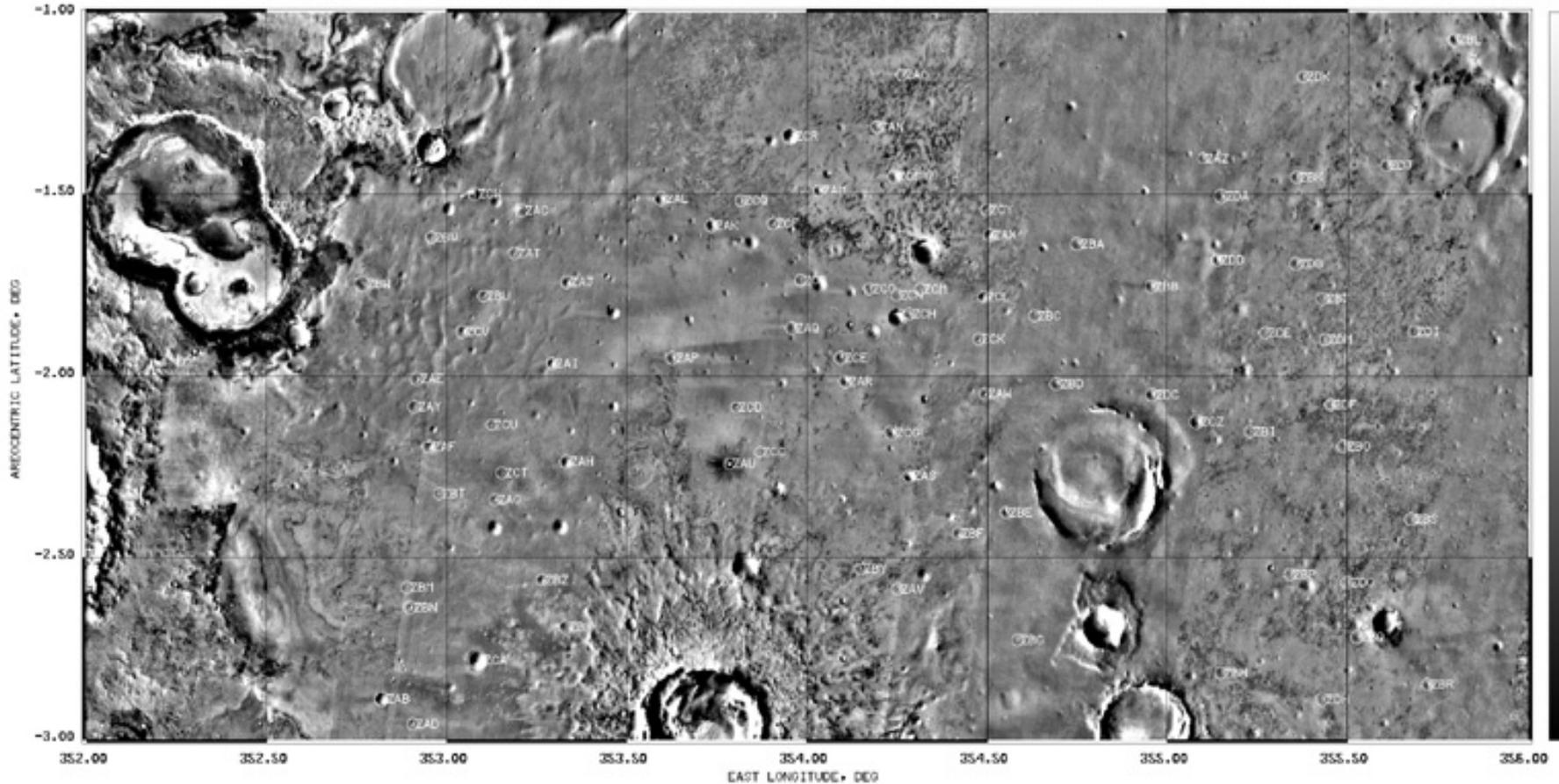




# *MER B Opportunity in Meridiani*

## *ODYSSEY THEMIS IR / MGS MOLA*

THE MERIDIANI LANDING SITE

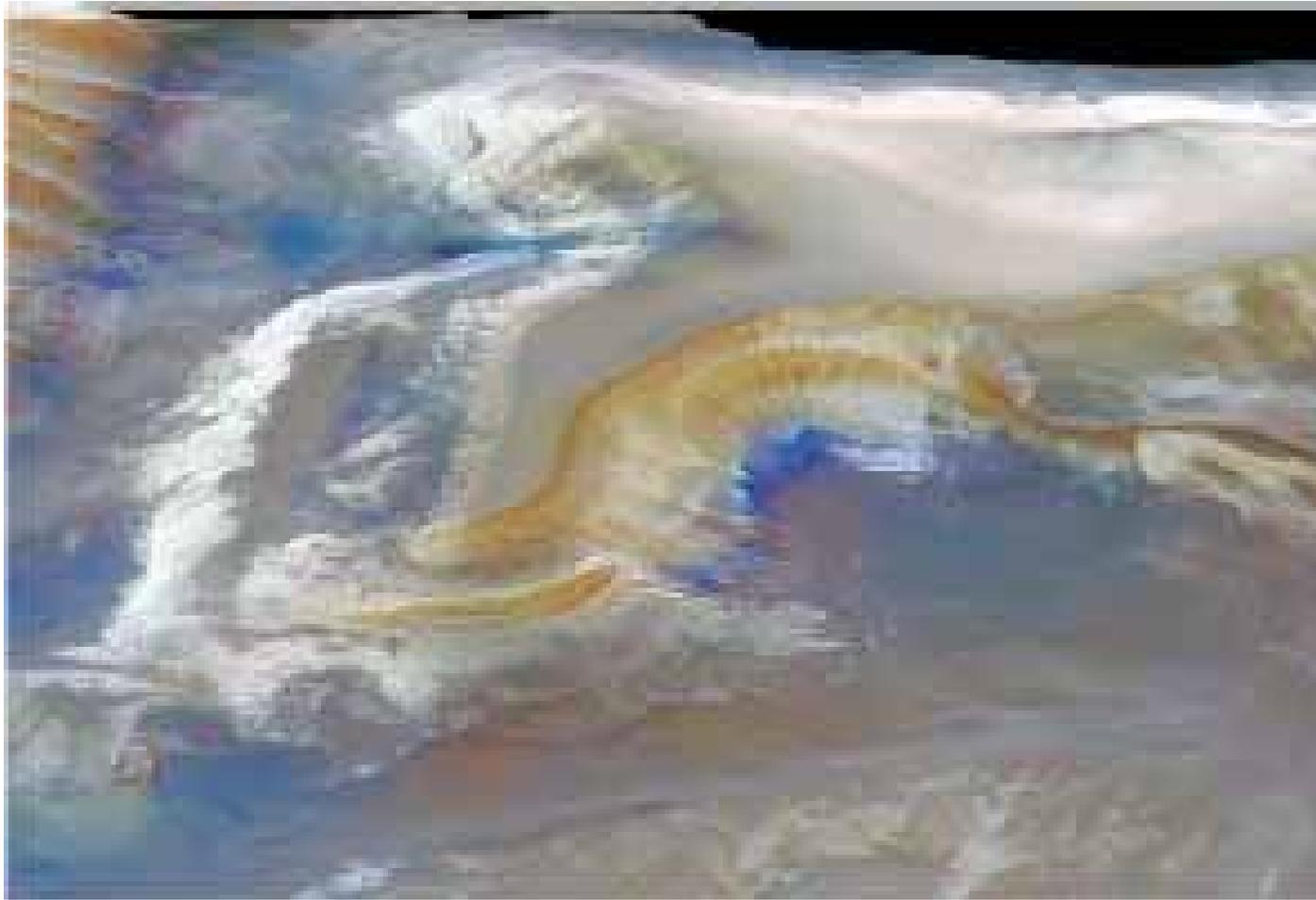






# *Mars Express HRSC / SRC*

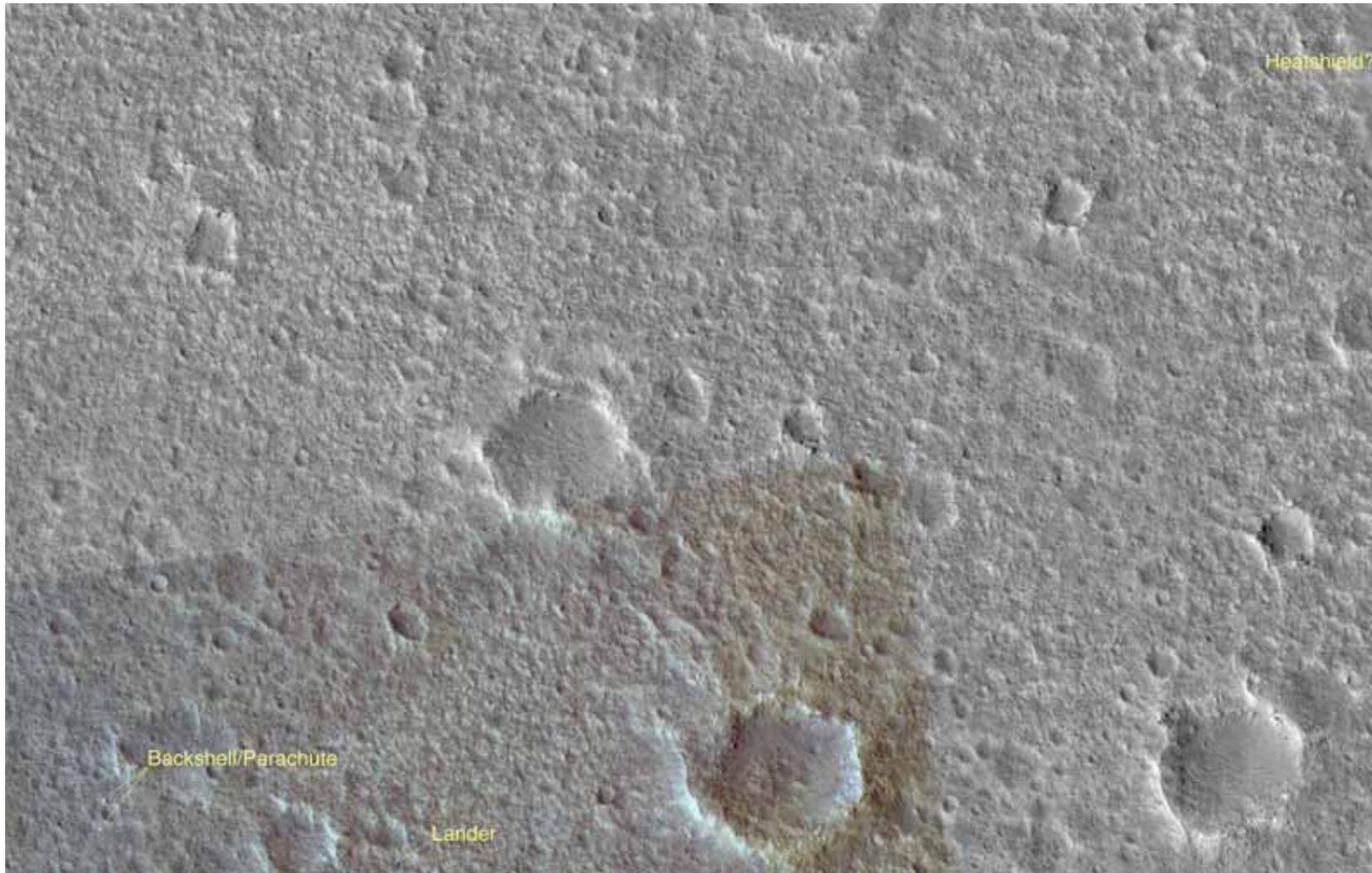
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**ESA / MEX / Freie University / HRSC / G. Neukum - PI**



# *Viking Lander 1 as seen by MRO HiRise*



NASA / JPL / MRO / Univ of AZ / HiRise / A. McEwen - PI



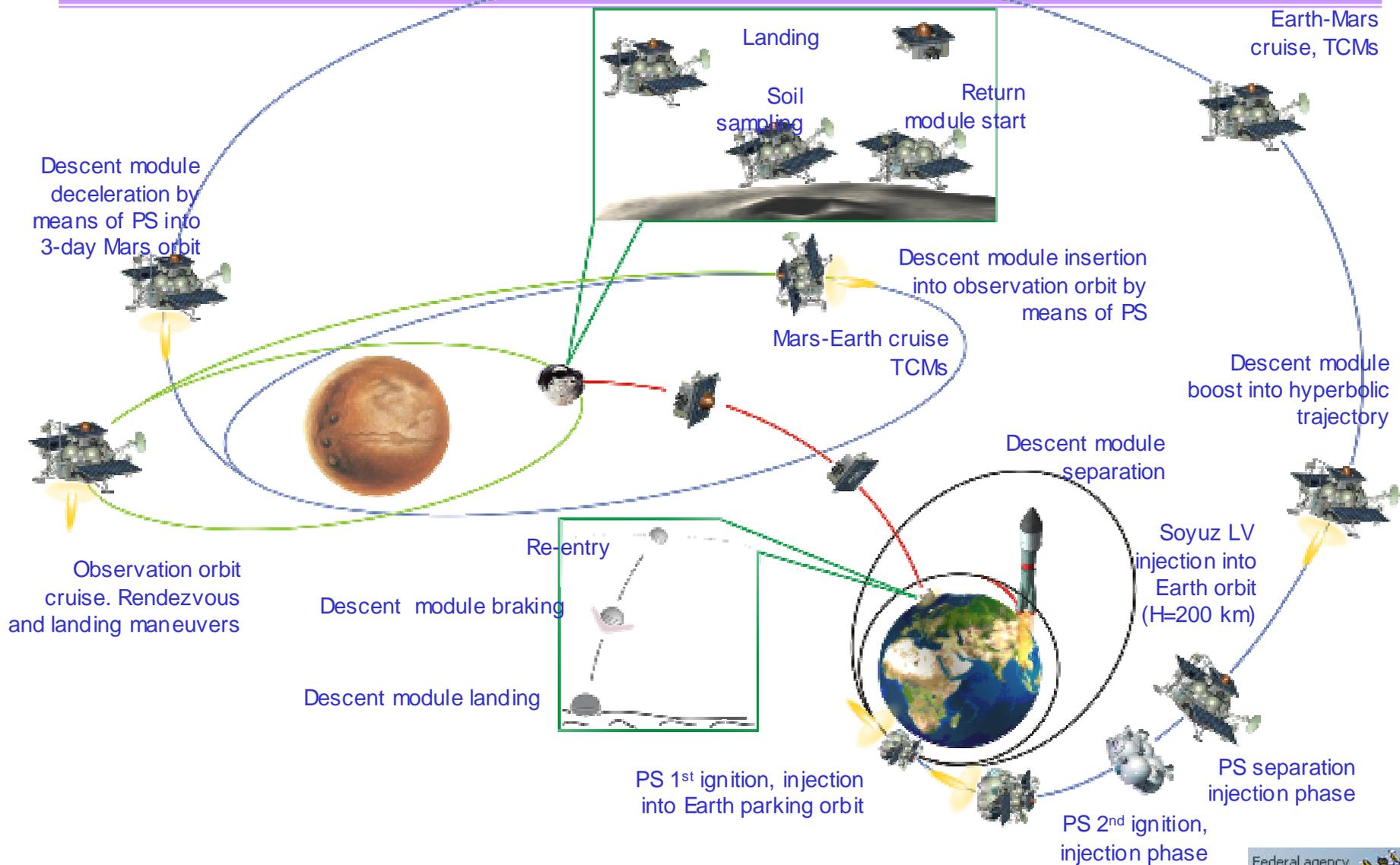
# *Mars Cartography Status*

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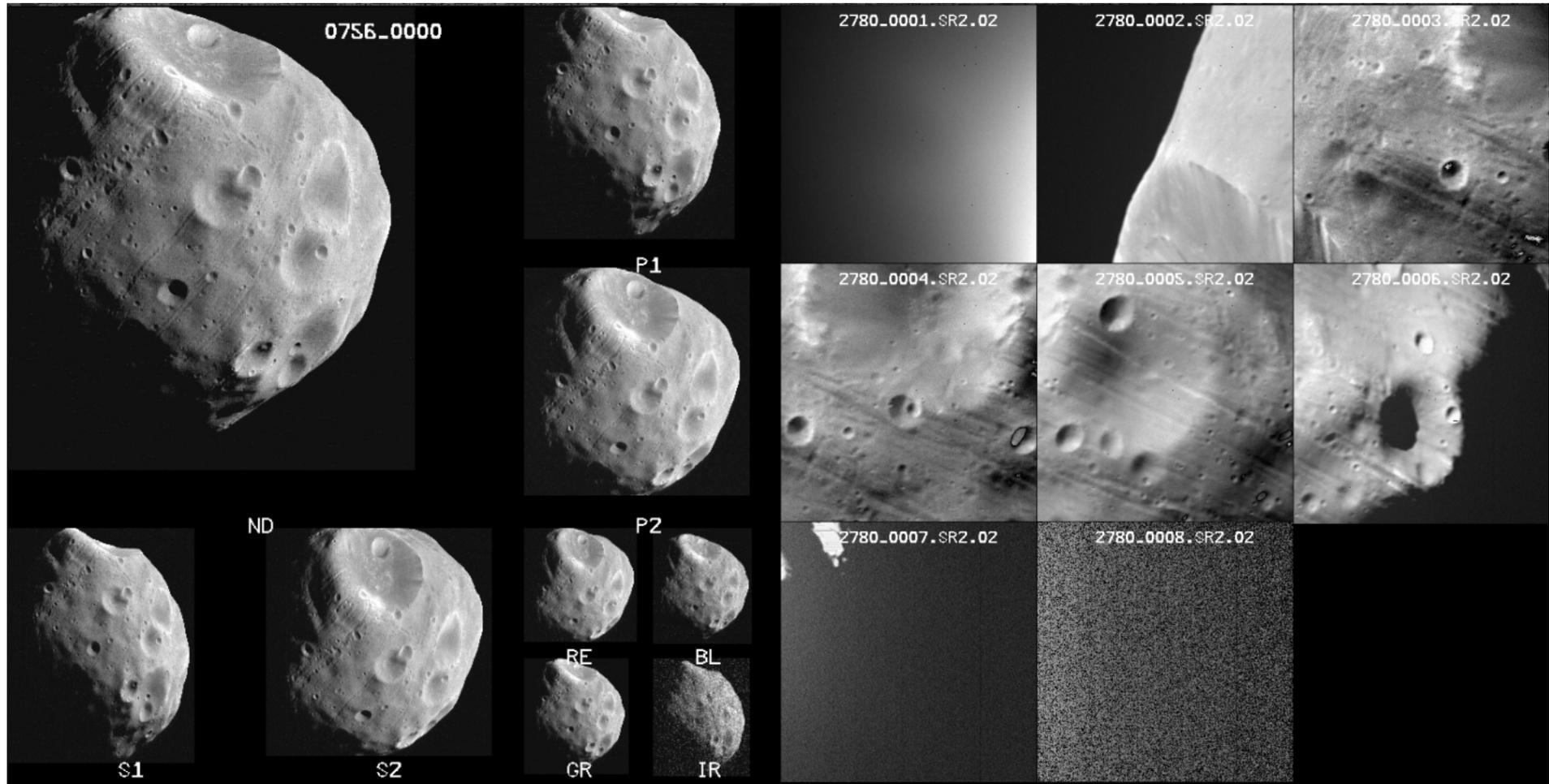
- **Precision cartography for Mars landing sites is now common place**
  - **Global MOLA DTM exists for absolute control to < 100 m**
  - **Precision gravity field exists to compute orbits to < meters**
  - **Precision star cameras exist to provide control / knowledge to 100 m**
  - **Precision camera CCD detectors exist having negligible metric errors**
  - **THEMIS IR global coverage at 100 m / pixel exists**
    - ☞ **Replaces Viking Orbiter MDIM's by USGS @ 230 m / pixel**
  - **Precision absolute control points exist < meters**
    - ☞ **MRO HiRise images of VL-1, VL-2, MPF, MER A and B against Mars background (surface features in global control network)**
  - **Precision overlapping, stereo, and multispectral imaging of sites**
    - ☞ **ODY THEMIS VIS and MRO CRISM - 18 m / pixel**
    - ☞ **MEX HRSC - stereo at 15 m / pixel**
    - ☞ **MGS MOC and MEX SRC < a few m / pixel**
    - ☞ **MRO HiRise - 35 cm / pixel**



# NEW SCIENCE CHALLENGE- PHOBOS SAMPLE RETURN (TPYHT)



*ESA Mars Express is building up global, multispectral, radar sounding observations for GPVHT*



**Also, HiRISE to image front side of Phobos in stereo next month**



# *Expected ГРУИТ Results*

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QuickTime™ and a  
decompressor  
are needed to see this picture.



# *Expected ГРУНТ Results*



Return Capsule: descent



recovery