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- 1. HiRISE image data characteristics
- 2. What HiRISE can do for you
- 3. What HiRISE can do to you
- 4. Safe-haven landing sites



Ancient bedrock in Uzboi Valles, PSP_3499_1520



HiRISE "Pushbroom" Imaging





• S/C orbital motion (Nadir) "pushes" sensor projection across ground

• Line integration timing is identically matched to orbital ground speed (~3.2 km/s or 19,200 mph!)

• 25-32 cm/pixel

• Sensor (linear array of pixels) integrates during motion of single pixel: ~0.0001 second!



HiRISE at Mars: October 2007

- ~3800 Mars images returned
- ~9 Tb of data, 2900 Giga-pixels
 - Covers <0.3% of Martian surface
- ~390 stereo pairs completed

20 m

 Prints in this room show < 0.01% of the HiRISE data

PSP_5330_1275





HiRISE Characteristics at 300 km altitude

Ground Sampling	30 cm/pixel
Dimension	
Resolution	~90 cm (3 pixels
	across object)
Swath width (Red)	6 km
Color swath width	1.2 km
Maximum image size	20K x 120K pixels
Signal:Noise Ratio	>100:1
Color Bandpasses	Red: 550-850 nm
	Bl-Gr: 400-600 nm
	NIR: 800-1000 nm
Stereo topographic	~20 cm vertical over
precision	1 m ² areas

Terra Sirenum, chloride? PSP_5680_1525, IRB color





- EDRs--raw data, 28 channels per image
- RDRs Reduced Data Records
 - Radiometically calibrated to I/F
 - Geometrically reprojected and rectified via smoothed MOLA (do not use for stereo)
 - Grayscale (full swath width) and color
 - Eventually:
 - stereo pairs with precision geometric corrections but no reprojection
 - ~20 Digital Elevation Models (DEMs)
- Extras reduced scale or slightly lossy JPEG2000 compression
 - Browse jpegs (2048 pixels wide)
 - Lossy JPEG2000 version of RDRs
 - NOMAP products--CCDs stitched together but raw geometry
 - Grayscale and IRB and RGB color
- Note that weekly sets of captioned image releases are full PDS releases.

HiRISE Color Notes

IRB = Infrared, Red, Blue-Green
RGB = Red, Blue-Green, synthetic blue
PDS color RDR given one min-max stretch for all 3 color bands

Consistent color from image to image

Extras: Each channel is given an independent min-max stretch

Enhancement depends on scene.





Stereo Data Acquisition



- Acquire ~1000 stereo pairs in 2 years
- Digital Elevation Model (DEM) resolution ~1 m
- Require $\theta_1 + \theta_2 > 15^\circ$ for 0.2 m vertical precision





Left: DEM of part of Columbia Hills (Kirk et al., submitted.)



HiRISE Stereo Notes

- Anaglyphs appear vertically exaggerated to varying degrees
 - Look for angle-of-repose slopes (30-35°) for qualitative interpretations
- HiRISE team produces DEMs for science only, not landing site characterization.
 - CPD funds landing site work
- Do not use HiRISE RDRs for DEM production or stereo viewing
 - They have been orthorectified via a smoothed MOLA dataset for better correlation with other map products like CRISM and THEMIS.





VL-1 Lander and Backshell















Pathfinder Landing Site in Ares Valles









Search for Mars Polar Lander









Opportunity Heat Shield



CRISM-HiRISE Coanalysis





Nili Fossae Trough

Green = low-Ca pyroxene

Blue+magenta = smectite-bearing clays

Subsurface stratigraphy exposed in Ritchey Crater central uplift





THEMIS-HiRISE Coanalysis





HiRISE color infrared

Phyllosilicate-rich?





Oblique view of a portion of Mojave crater

Happy Halloween!



Prediction: HiRISE DEMs will be the grim reaper of candidate MSL landing sites.



How to find safe-haven landing site candidates:

High-contrast THEMIS night-IR almost always corresponds to terrain that is rough at the scale of meters



Candidate Safe Haven Landing Site



Bland THEMIS nighttime IR is no guarantee that the surface will be smooth at the scale of meters.









Edge of alluvial fan (Moore and Howard, 2005)





Bakhuysen fan



Mostly infilled by eolian sediments so it's safe to land here, but there are outcrops of light-toned materials, probably phyllosilicates (TBD CRISM)

