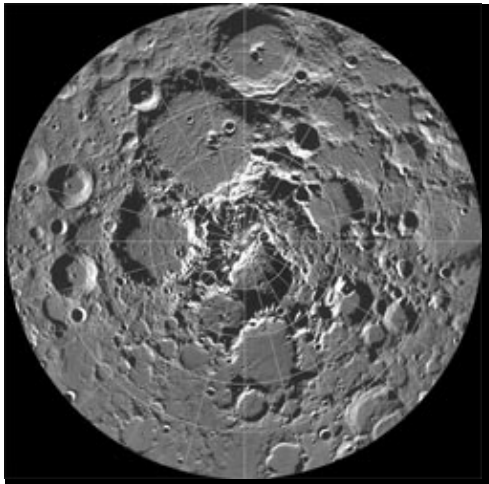

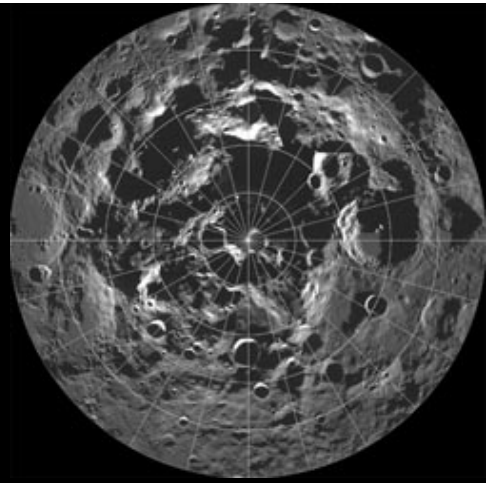

Lunar State of Knowledge

Ben Bussey

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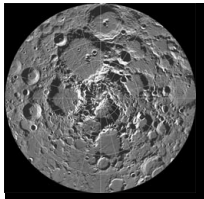
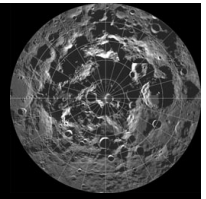


Why the Moon?



It's close

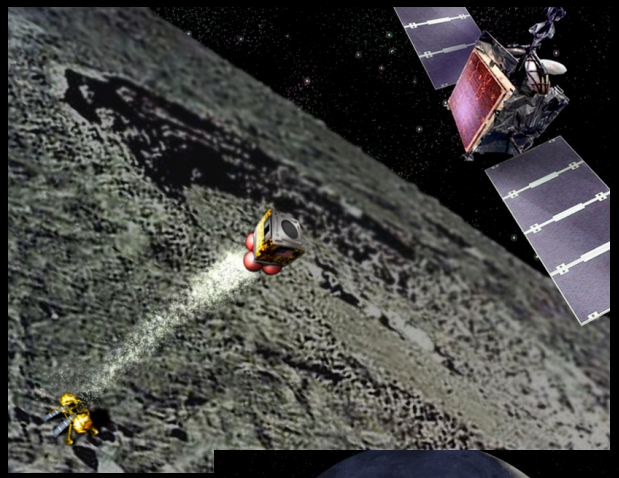
- Three days away and easily accessible (as near as GEO)
- Transport system to Moon can also access GEO, cislunar, Earth-Sun Lagrangians, and some asteroids

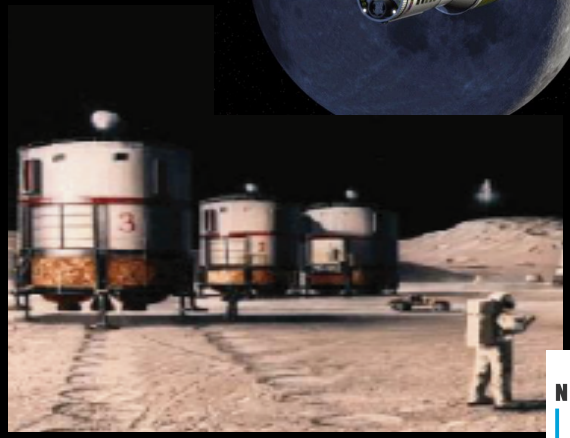
It's interesting

- Moon contains a record of planetary history, evolution and processes unavailable for study on Earth or elsewhere

It's useful

- Retire risk to future planetary missions by re-acquiring experience and testing with lunar missions
- Development of lunar resources has potential to be a major advancement in space logistics capability





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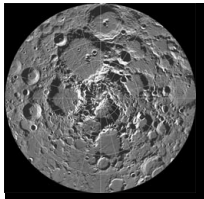
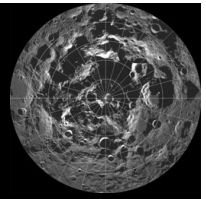
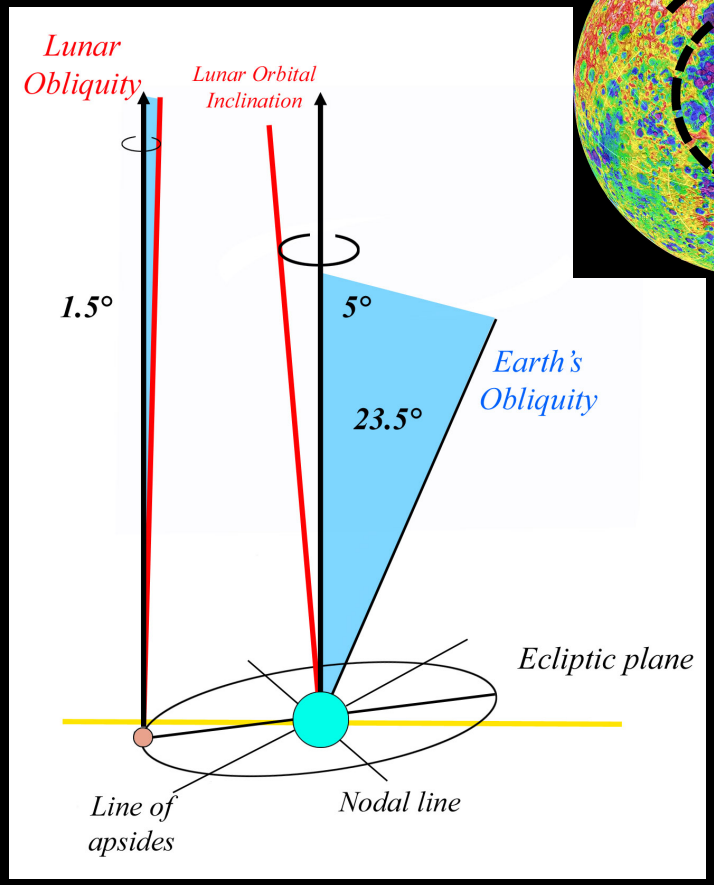


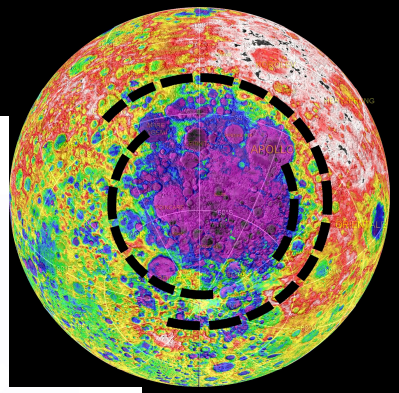
Why the Poles?



Interesting for both operational and scientific reasons

- Low Lunar Obliquity (1° 32´)
  - Causes unusual illumination conditions
- Areas of Quasi-Permanent Light
  - Prominences stand above the local horizon
  - Low, constant surface temperatures (~220K)
  - High flux on vertical surfaces
  - Serves as solar power source
- Areas of Permanent Darkness
  - Only scattered light or starlight
  - No direct solar illumination
  - Very low temperatures (~50-70K)
  - Serves as cold trap for volatiles
- View from the Earth
  - Lighted Areas
    - Two weeks of visibility / two weeks obscured
  - Shadowed Areas
    - Mostly permanently obscured





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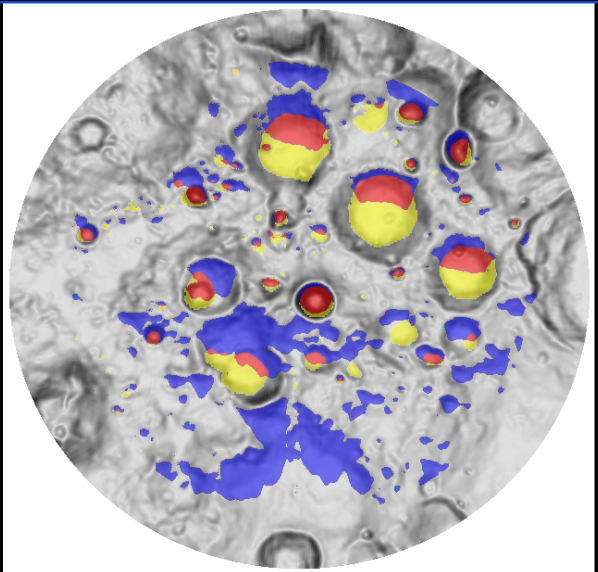
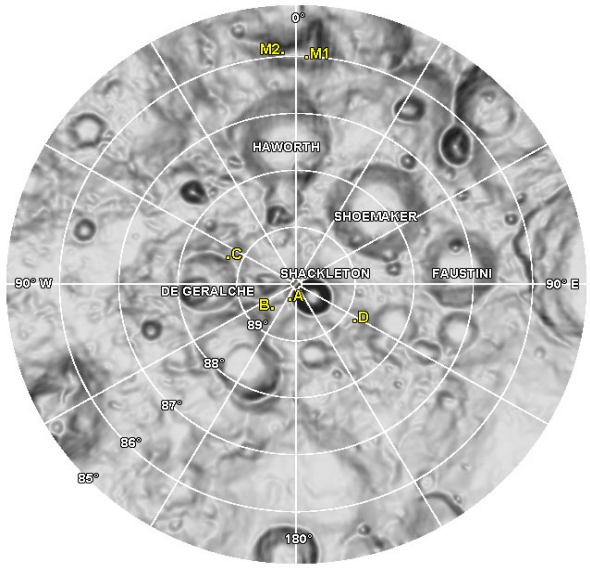
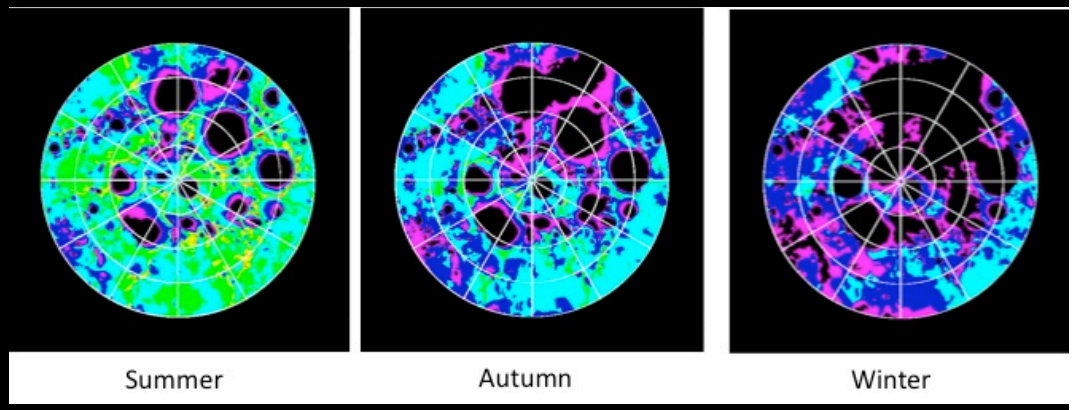
Polar Lighting







- We now know the location of the most illuminated sites at both poles
- We can fully characterize their illumination history
- Key areas are continuously illuminated for several months
- We know the temperatures within the perman shadowed regions…… Cold!

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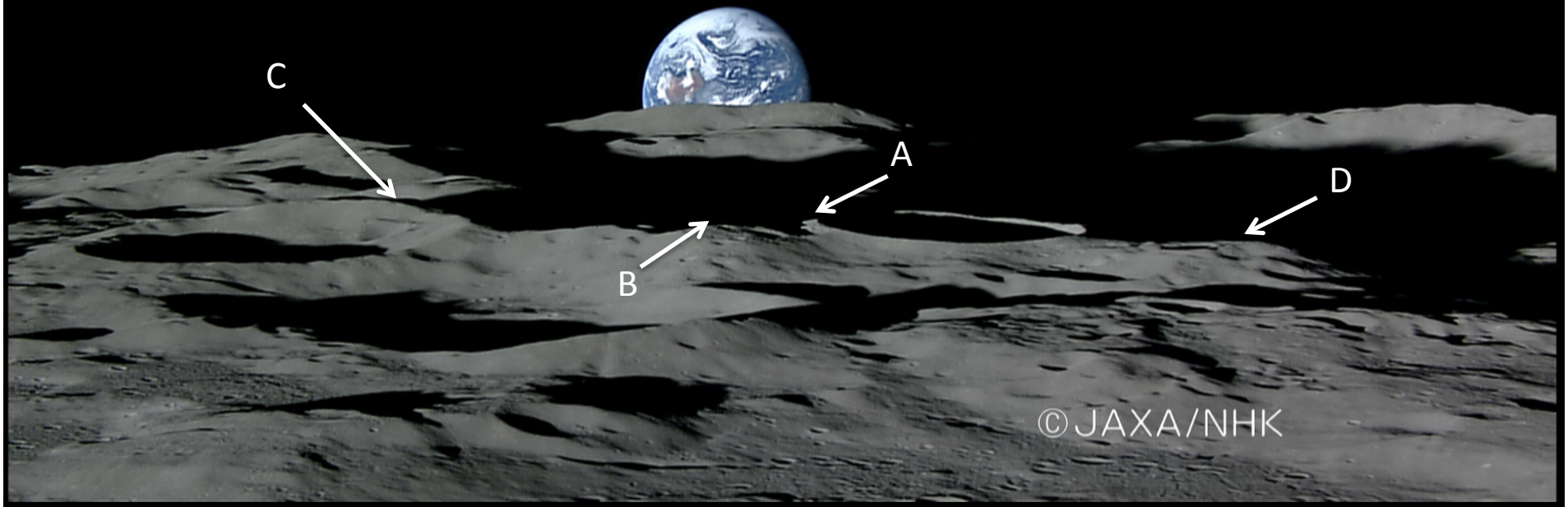
Television is Educational!



The Search for Ice: Is the Moon "Dry"?

- Ice is a resource: Oxygen, water, fuel
  - Two orders of magnitude less to extract H_2 from ice than equatorial regolith
- Lowers cost, learn to live off the land
- Multiple evidence that the Moon is not a "Dry Moon"
- The search continues…

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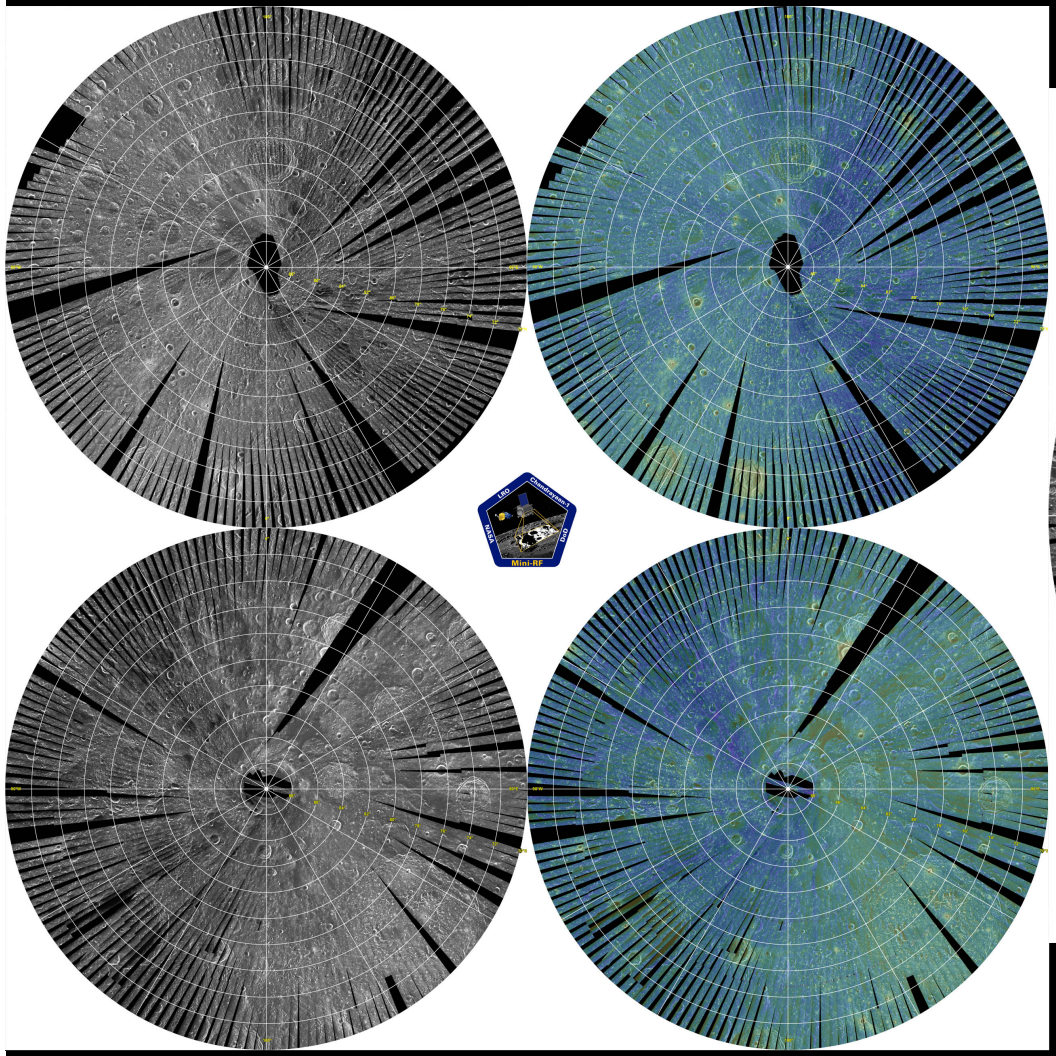
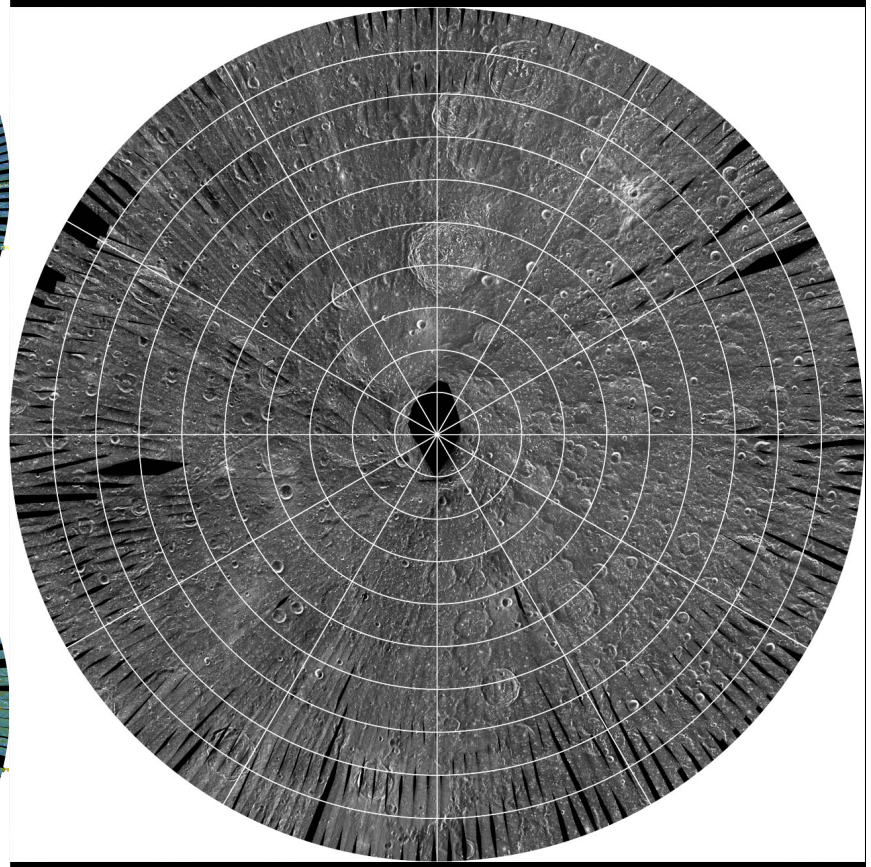
Mini-RF Polar Mosaics

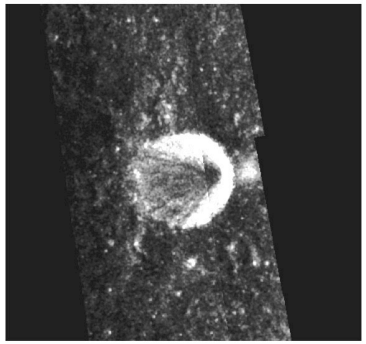


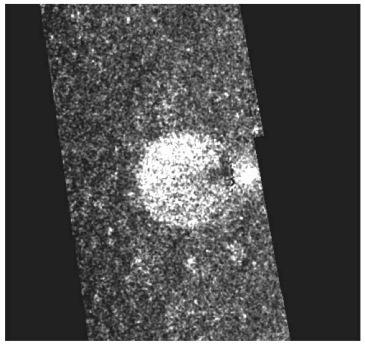


Looking for Ice

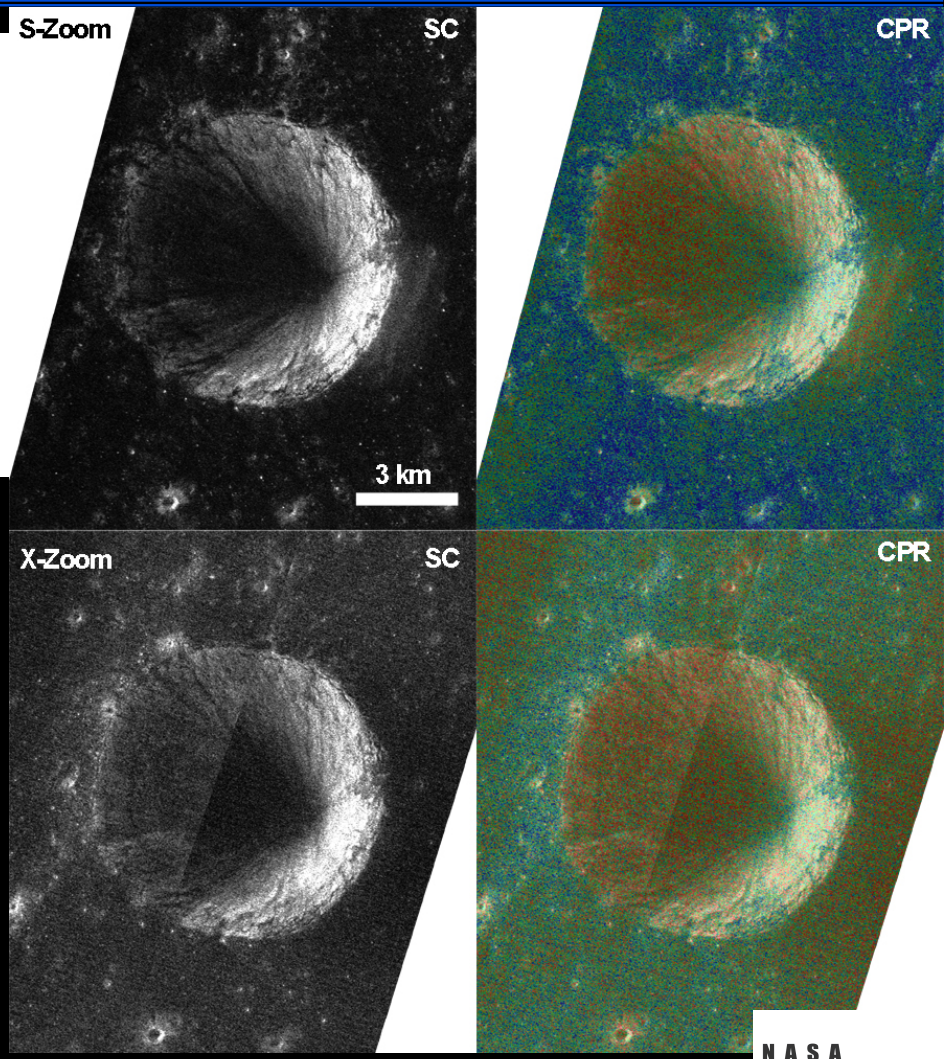
Anomalous crater on floor of Rozhdestvensky (polar)

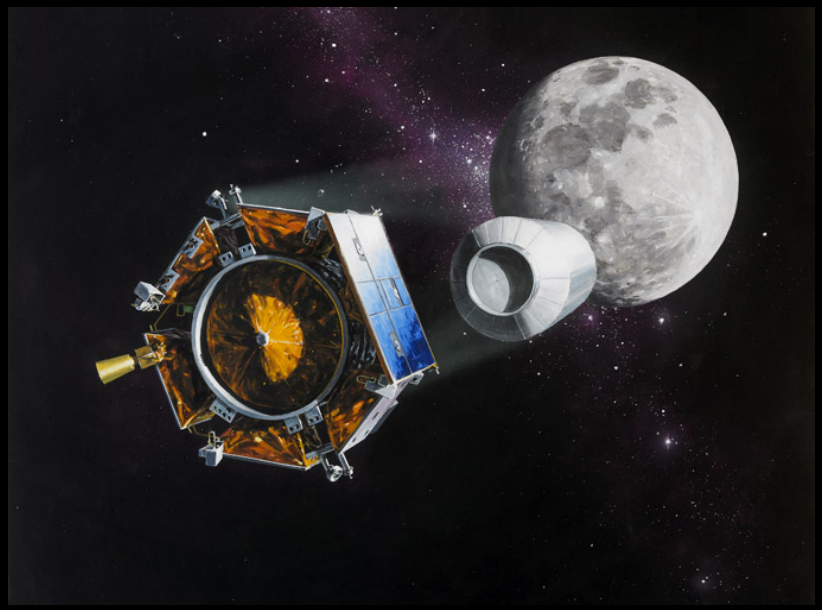
SC



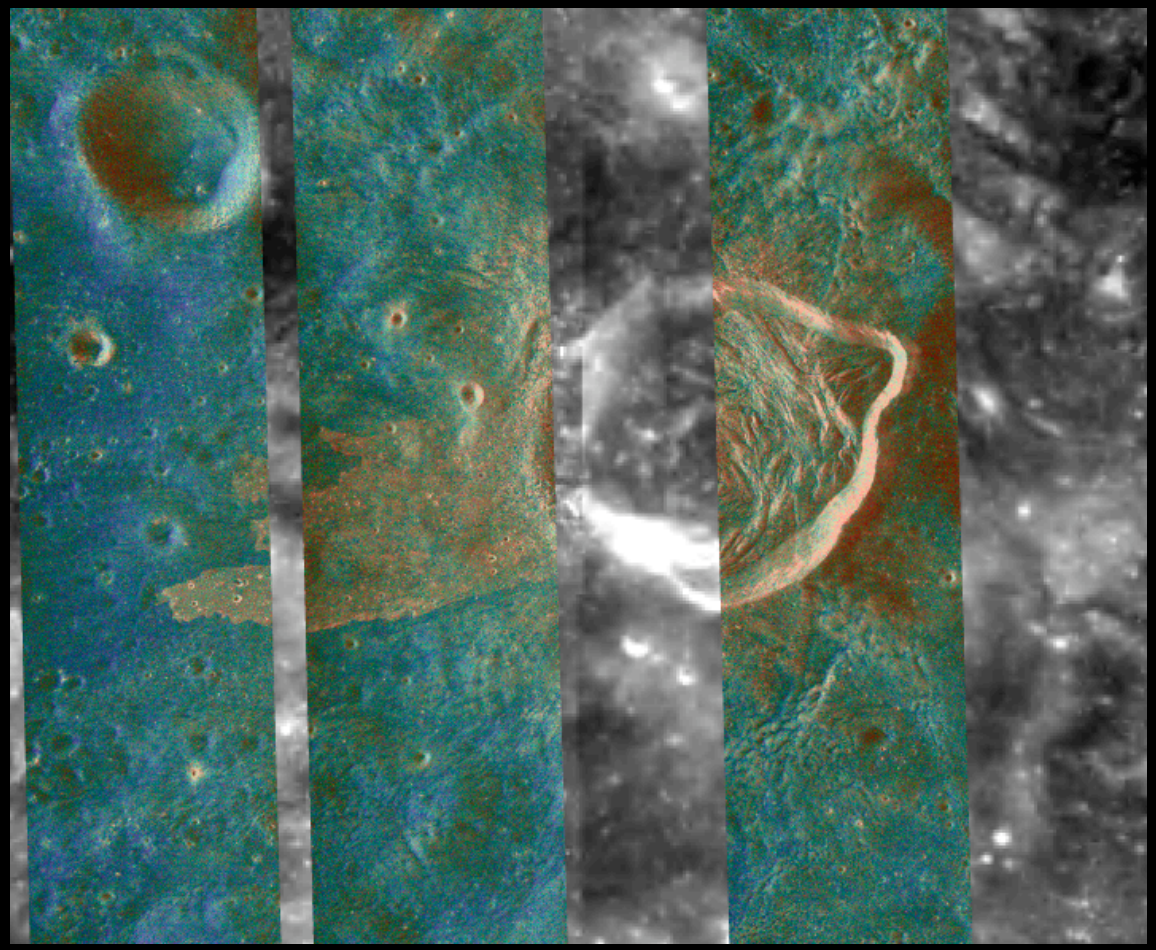


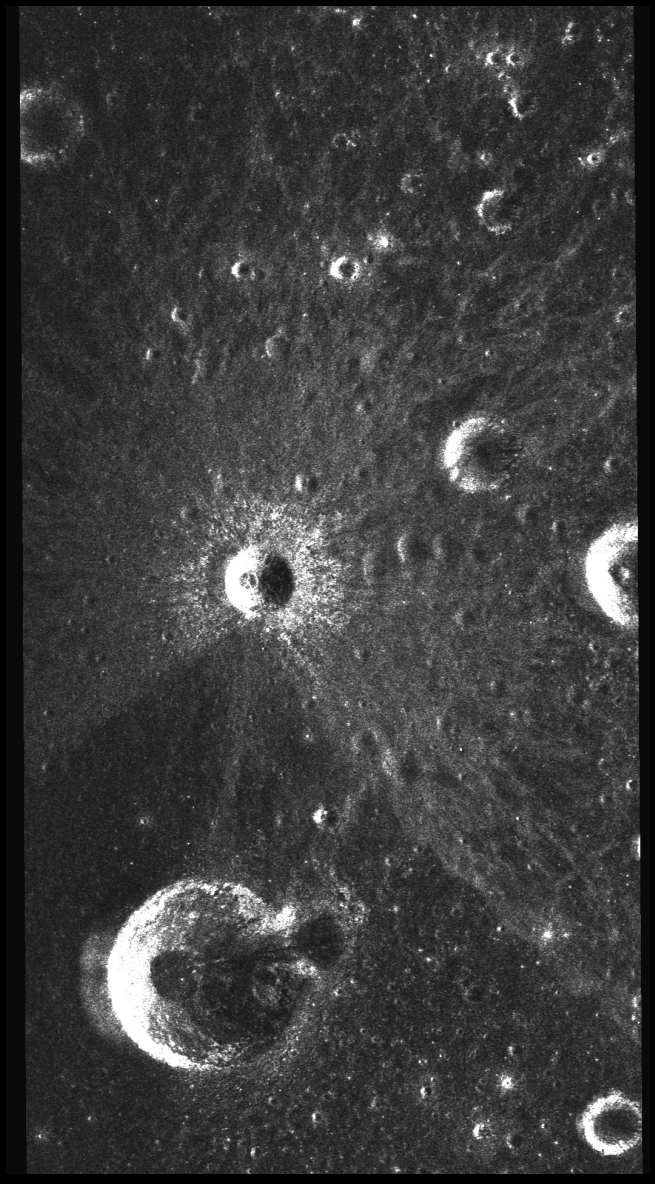
CPR



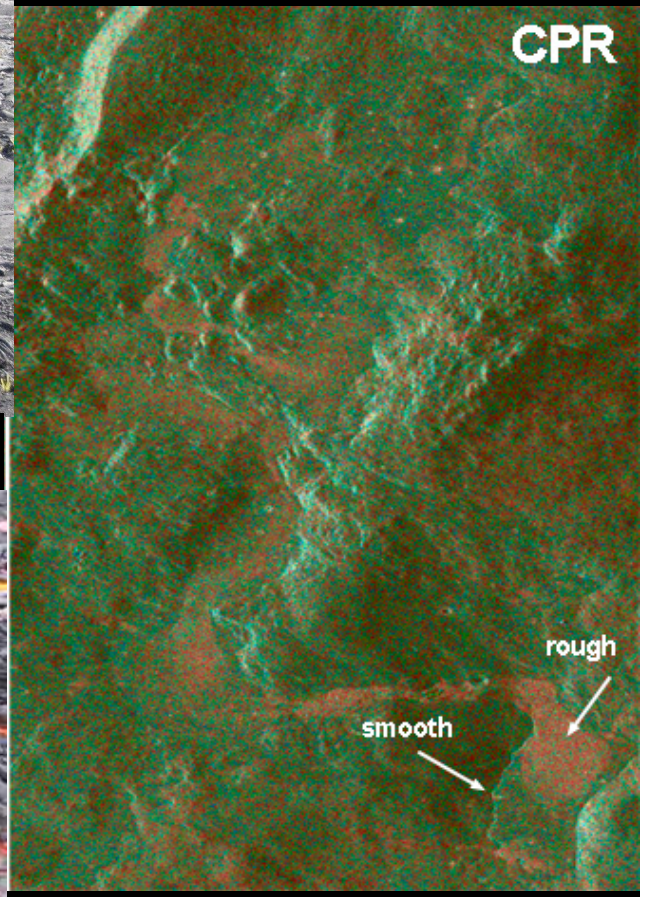


Mini-RF Impact Crater Images





Melt Flow Roughness



Thoughts for Discussion

- We know enough about the Moon to make decisions on where to go.
- We know the best places to land from an illumination perspective. These represent a finite resource.
- We know that the Moon has a "Water Cycle"
- We have optical and radar data that permit the characterization of landing hazards.