

## Planetary Science Decadal Survey: Inner Planets Panel

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Notes by Elena Amador

### OPEN SESSIONS

#### Carle Pieters – Brown University and Moon Mineralogy Mapper (M<sup>3</sup>) Team Results from M<sup>3</sup> Chandrayaan 1

- Discussion of M<sup>3</sup> Instrument and what it is capable of
  - o Spectroscopy of lunar surface, searching for H<sub>2</sub>O/OH
  - o Discovery of several areas with relatively strong 3-micron bands, implying H<sub>2</sub>O/OH
- Recommendations: M<sup>3</sup> provides a test of what is possible.
- Re-flight of M<sup>3</sup> is urged at the soonest possibly opportunity
- The low-resolution near-global M<sup>3</sup> data have already identified several compositional surprises across the surface.
- Many certainly merit low-cost sample return and/or detailed in-situ analyses

#### Mark Robinson – ASU

#### Results from LRO

There are probably a lot of really small craters that are permanently shadowed – LOLA is telling us this

- There are many LRO investigations that could be addressed by small (Discovery) scaled missions
- 10% of moon at highest resolution ... are you flexible at where you target these sites?
  - o Yes. Science community can input to the target database
  - o Maybe a little more than 10% now.
- What is the plan after the 1 year nominal mission?
  - o Phase change to smd mission. There is enough fuel to go back to low energy orbits that we could stay for 10 to 12 years based on the amount of fuel. All will depend on funding, not the spacecraft.
- Has the team settled on a science mission orbit?
  - o Extend 50km orbit out for another 6 months. Then go to a transitional orbit
- We could map the whole moon at 1 to 2 meters per pixel, if we stay that these orbits for 5 years

## Jeff Hall – JPL

### Technologies for a Venus Flagship Mission

- No simple answer to what technologies will be needed for a Venus flagship mission
- High priority options that would do fantastic science but are not yet technologically ready
- Landers that would survive for 5 hours or balloons that will last for 30 days
- What is the rationale behind creating this large flagship mission?
  - o Typically we would always think of flagships missions as going to the outer solar system, you can only go once a decade. Or measurements that need to be made simultaneously.
- What is the rationale of doing this big mission, instead of many smaller missions?
  - Both rationale fit this mission, just because it is close doesn't mean it's easy to get to.
  - o Balloon Technology >>30 days that would be a fundamental technological challenge. Need to ensure that the acidic aerosols in the atmosphere doesn't create holes in the balloon and bring them down.
    - Small leaks can accumulate over days and weeks.
  - o Suggestions for looking for seismic signals from Venus express data.
    - Not promising enough to suggest doing at the surface
- Team would like to have a low altitude balloon from the 2006 roadmap. It could fly near the surface and take lots of images, but you need a long duration power source. You need to survive for an appreciable amount of time to really move about.
- The only credible idea right now is making a metal balloon. But this is very low TRL.
- If your lander can work on the time scale of 24 hours, this may give us time for the operators on Earth, they may be able to communicate with the lander and work with the data they are receiving – thermal technologies could help with this.
- HQ deferred funding probably because they wanted to see priorities that come out of the decadal survey.

## Krishan Khurana – UCLA

### Artemis Mission Update

- Heliospheric Mission in MIDEX program
- Lunar surface charging
- Dust levitation in electric fields
- More water at higher latitude of the moon than the lower.
- It will be of the similar kind of resolution that you saw from the Apollo era data
- Sounding signal and response and we should be able to separate that

- In support of LRO, ARTEMIS provides comprehensive monitoring of lunar space environment
- How long would the spacecraft last?
  - o This is expected to last – they last forever (fast spacecraft) it all depends on what kind of orbit they take. If at 200-400 km then they could last indefinitely.
- Heliospheric and planetary communities are coming together – looking for funding
- International lunar network – 2018 before you actually launch

Timothy Swindle – UA and F. Scott Anderson – Southwest Research Institute

In Situ Data 1 and 2

- Difficult to think about doing this on Venus because it's inherently difficult to do it in the environment, or because the rocks have the data screwed up because they've been in that environment for so long.
- There's no reason why you couldn't get both noble gas and Rb/Sr ratios. Integrated system might be stronger... if you can get multiple dates that is always better than just getting one.
- The heat of the surface of Venus is a problem
- Solar heating, as you get further in the solar system
- The ages of craters may be one of the things that you are interested in getting, but craters are much better at throwing things around. Things could get reset by craters when we don't want them to. A worry if we're trying to find an age of an impact
- A pathway to get to age dating on Venus
  - Not possible in any near term missions
- Venus and Mercury are our number one age dating priorities
- We have to synthesize all this into a decadal wide recommendation, not just our own panel's priorities.

OPEN SESSION Committee Discussion

VEXAG

- Venus exploration will need to be an international effort. VEXAG has been trying to contact other agencies to try to start coordinating this. There is no formal agency to agency coordination to these missions. Scientist to scientist dialogue is a plus.
- We can't fly as many balloons as we're going to need. If we have coordination we can accomplish more by having assets there at the same time. How to make it happen isn't entirely clear, but as long as we have dialogue and are thinking about doing this than we are taking a step forward.
- Outside question – is the panel planning any discussion especially to Mercury?

- Committee—not at this time, all though we have asked for a lander study to be put into commission so we'll be discussing this in closed session
- How will the steering committee handle recommendations to handle infrastructure?
  - The steering group will take all the recommendations and prioritize.
- **DSN white paper** – the S band is critical. We need to preserve data rate return – This is an area of concern.
  - DSN – data rate shouldn't just be preserved but it needs to be enhanced! 20 megabytes per second is what it needs to be. DSN always seems to fall through the cracks.
- **How are we addressing water on the moon?** M<sup>3</sup> data came after the white paper submission deadline.
  - We invited Mark and Carle. Their results are happening in parallel with our process. Their results will be changing on a day to day basis. We're counted on them, if they know something that will affect us, they can contact us. Then we can put together a formal teleconference, etc.