Small Body Science and Technology Panel

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Framing some of the issues

- How are [near term and far term] science opportunities limited by existing technology?
- What cross-cutting technologies have the potential for changing the way small body science is done?
- How might technologies enable small bodies science support for human exploration/activities?

How science goals drive technology development, and technologies enable measurements

- Small bodies science advances
  - No longer just reconnaissance, but detailed studies are needed
  - More difficult and complex measurements, and more targets of interest
- Find an appropriate balance between near-term needs versus long term, enabling technologies
- The external environment is, as always, uncertain (but especially now)
  - NASA and SMD funding pressures
  - New directions for human spaceflight

Missions enabled by existing technology, and limitations thereto

- Near term, <10 yr, mission concepts are enabled by existing technology (with limitations), e.g.
  - Multiple flybys, of NEOs, JFCs, and/or MBAs (what can be measured in flybys? Not even density? Flyby sample returns are possible, with limitations from capture technology)
  - Rendezvous with NEOs or MBAs (what can be measured from orbit, without touching the surface?)
  - Landers on NEOs or MBAs (more detailed measurements of composition and physical properties than is possible from orbit, but less capable for composition than returned samples; detailed physical properties may require anchoring and/or surface mobility)
  - Basic sample returns from the most accessible NEOs (hand-size samples with context, without extensive in situ measurements; warm, non-volatile samples only)

More detailed measurements

What technologies may promise breakthrough science?

- Small bodies *as a population* are more diverse than any planet
  - A small body is analogous to an outcrop or a single rock on a planet
  - Only a few small bodies are accessible; some NEOs are outer solar system objects; small bodies are spread throughout the solar system
- How can we characterize and understand such a numerous and diverse population? How many missions can we afford?
  - Propulsion as the most important limitation
  - Need to make measurements from farther away, in less time, for fewer resources (so we can visit more targets)
- How can we take advantage of cross-cutting technologies?
  - Can we look to Mars Sample Return, the likely next Mars flagship (sampling, encapsulation, EDL, curation, planetary protection)?
  - How different are comets from asteroids in terms of sampling requirements (warm versus cold, volatiles or no, planetary protection)?
- How can we derive science benefit from human exploration of NEOs?
  - How about investment in instruments and measurement techniques that require, or are enhanced by, astronaut interaction?

Are there holes in technology development due to lack of communication between scientists and technologists?

Let's find out