NASA SBAG Meeting- Day 3

January 26, 2011

Sykes: Welcome to the third day of our fourth SBAG meeting.

Mark Sykes (PSI) presented

- Data Archiving and Access
  - Small bodies data has no expiration date
    - How do we safe and distribute our data?
      - Electronic archiving and distribution via Internet
        - NASA Planetary Data System, Hubble IRSA, RELAB
      - PDS Small Body Mission Holdings
        - 25 missions, no TNO's yet
        - Small data sets, but of real value
        - We'd like higher level data products in archiving, but not financially valued as much as the general mission.
        - Focus on the minimum is true of missions and data projects
        - Find new ways of scoring the projects to increase level of data acquired
        - NSF does have a requirement of data management
        - Less than 20 proposals in the past year for data collection
        - We'd also like the information to be usable and easily archived.
        - Currently, there aren't programs to make data readily accessible.

Guest: When we got the data from NEAR, we had to kick in $50 K so that it was usable to the community. NASA does need to assure that the data is usable.

Sykes: PDS doesn't have the staff to teach the community how to use the research programs. We're working on that.

- We should able to easily find and access all small bodies' data.
  - The issues is finding and accessing small bodies' data.
  - We have a very diverse body of target data.
    - Example of a PDS search on CERES
    - Ferret is under development with PSI

Guest: Claudia Mark was delving into the problems with PDS and she would be a good resource for PSI.

Sykes: Yes, better interface is needed and we're working on that.

Guest: It's difficult to search when there's so much information. Some are outlining the problem and narrowing it down.

Guest: It makes sense to collaborate with the high energy scientists. We do have a problem with funding.

Sykes: We're going to maintain pressure to get this process into motion a little faster. Within PDS, there is collaboration across the sciences to have community evaluation and input.

Sykes turned the meeting over to Hal as he had a meeting at PSS.

Dan Britt from the University of Florida.

- In-situ studies

Britt apologized that he was still in the data gathering phase of the process.

  - Delivery methods (technologies) available are very important
  - Look at what we would like for programs
  - We need a lot more data collection

Web guest: In my recent experience in designing missions, there's been some conflict over how much is done in-situ and how much study to be done by bringing a sample back.

Britt: I'm a big fan of both, but there are some studies that can't be done in-situ.

Guest: I'm in complete agreement, especially with spectrometry. This is especially true of dust.

Guest: I'd like to point out that you should include international instruments.

Britt: Yes, I agree. I was not limiting my scope.

Guest: How does you science depend on how well you've made the measurement?

Hal: Review Joe Nuth's section on priorities.

Britt: It's absolutely dependent on the science.

Guest: That's what's fun about this group. What you measure on a comet is going to be different from an asteroid, etc…

John Dankanich- NASA

Technology Capabilities and Needs

- See the SBAG website for the roadmap document.
    - The diversity of targets and missions is broad, but there is also broad applicability.
    - In March, decadal release is expected to occur.
- Methodology
    - Emphasize clear gaps
    - Do not emphasize enhancing
    - Emphasize enabling technologies
    - Prioritization based on science benefit and the mission infusion/ applicability expectation.
- Current Sections of roadmap
    - There are many things we'd like to do, but prioritization is vital
    - Feedback is desired
    - Many things are covered in the document, and are categorized
- Power Systems
    - Solar Power
    - Radioisotope Power
- Propulsion Systems
    - Chemical
    - Electric (high priority)
        - REP needs $1M per year to continue
- Remote sensing instruments
    - Variable Focus Distance Imager
    - High Resolution Topography Instrument
    - Low -Speed Dust Detector

Hal: Add Radar Sensors and Thermal Imager

Dankanich: As people raise the priority for those things, we'll consider it.

Guest: Support the classes of missions, rather than focus on the individual instruments.

Dankanich: Right, I agree.

Hal: Gordon Johnson is working on general planetary applications.

Dankanich: We're also working on that.

- In-Situ Instruments
    - Seismic Science System
    - In-situ material dating instrument
    - Compositional analysis instruments
    - Surface manipulators
- Sample Return Technologies from CAPTEM (December 1, 2007)
    - Solicited by the director of PSD
    - Provided 7 key findings

Hal: Please tell Mark to post this report to our website.

Dankanich: Yes, I'll make it available on the archive.

    - Aside from flagship missions, sample return will be performed for small body targets
    - Technology requirements based on:
        - Surface characteristics
        - Time to take the sample
        - Desired depth of the sample
    - Technology gaps remain for nearly all areas of return
- SR: Flyby Sample Collection
- SR: Touch- and- Go
- SR: Surface Collection
- SR: Subsurface Collection
- SR: Earth Entry Vehicle
    - NASA is currently investing in this design
    - Planning to launch by 2018
- SR: Recovery, Transfer, and Curation

Hal: Is Jackson planning to do anything different with Hyabusa II?

Dankanich: They are planning to enter an asteroid.

Guest: We've got to get the right definitions from CASEM. The key for small bodies is that we get a full understanding of what is involved as it is different from Mars.

- SR: Cryogenic Sample Return

Guest: In order to do a Venus mission, we need to have a lot of refrigeration. Will that help us?

Dananich: Venus is looking at nuclear power. I don't know how it will interface.

- Missing Sections
    - Nothing on communications yet
- Prioritization- Non-SR
- Cost and Schedule ROMs
    - Red- not funded
    - Yellow- partially funded
    - Green- fully funded
- Technology infusion
- Previous Roadmaps- Status
    - SSE Survey (2001)
    - SSE Roadmap (2007-2016)

Guest: How long do you plan on this document being?

Hal: Our findings are voluminous. We plan to submit an executive summary to NASA.

Dankanich: I'd like your feedback on how long these documents to be.

Guest: NASA would like a couple of pages of good ideas. Two or three pages would be best. We need to also show that communications are end-to-end.

Guest: This was a nice delineation. We need more emphasis on synergy. If we focus on astrodynamics and propulsion, we'll get things done faster.

Dankanich: That's absolutely true.

Paul Abell- NASA, JSC

Human Exploration

- NEO Workshop to be held February 22, 2011 at George Washington University (www.targetneo.org)
- Introduction
  - Human Exploration of Near-Earth Objects part of US National Policy
  - Human Exploration of NEOs Relevant to NASA Planetary Science Goals
- Identification of NEO Targets
  - ID NEO Targets in respect to human targets
  - Discover of additional NEO targets for human exploration
  - Synergy between exploration, science, and planetary defense communities
- Characterization of Mission Targets
  - Selection of NEO Targets compatible for spaceship/proximity operations
  - Selection of NEO targets for In-Situ resource identification/utilization
  - Basic reconnaissance
  - In-Situ Characterization

Guest: Is there a minimal characterization set?

Abell: Yes, it's something we're looking at and discussing. It would be great if it were 50 meters and up. Things that are spinning faster than two hours may be difficult to engage. Keep things as simple as possible.

Guest: It seems that the gravity on a small body would be less coherent.

Abell: Yes, then you're getting into micro-body stability. It depends on the body.

- Laboratory and Simulation Support
  - The physical environment of NEOs is unlike large planetary objects
  - Lab support needed regarding the types of materials
  - Stimulant development useful for understanding aspects of geotechnical properties
  - Physics-based simulations
- International Space Station
  - Utilization of the station to further exploration
- Robotic Precursor Missions
  - Initial assessment and operations
  - Support for crew activities on target
  - Extended operations after crew departure

- Human Missions
  - Preliminary Assessment of NEO performed via ground-based systems and robotic spacecraft
  - More detailed investigations
  - Human missions to NEO would combine remote sensing observations, in-situ analyses, and sample collection techniques
  - NEO would last for several days or more
  - Crew would perform experiments
- International Cooperation
  - International agencies, aerospace companies and research institutions
  - Hayabusa and Rosetta are examples
- Feed forward to other destinations
  - Stepping stones
  - Propellant for future robotic and human expeditions
  - Extended deep space mission technologies to be used on long duration missions

Guest: There's a lot of debris up there and it's difficult to predict in orbit.

Abell: Low earth orbit is actually more dangerous than out in space (.1-.2 AU). Arm your spacecraft to withstand low-earth orbit.

Guest: What about the larger pieces?

Abell: We're not planning to go to the asteroid belts. Most pieces are less than a few mms. The likelihood of larger is unlikely.

Guest: How has Spitzer helped with this understanding?

Abell: It has helped with albedos. We'd like to take advantage of Spitzer's observations before the cryogenics run out.

Guest: We are waiting for a budget to address these concerns. There are some synergies in the broader goals of the scientific communities.

Guest: When you get down to the tenths of meters, they're rotating very fast. Any thought on de-rotating these targets?

Abell: Yes, you're correct. There has been some talk of de-rotating for science missions, not human exploration yet.

Guest: is there routine collaboration between asteroid scientists and radar?

Abell: Yes, there is some coordination, but we'd like to have more collaboration. Some of these objects are not visible from Earth.

Guest: Are there complementary and supplementary actions based on the observations?

Guest:Yes, that information is available immediately on IRTF or other systems.

Guest: We need more classification of asteroids to match the characterization. It's congressionally mandated to focus on detection rather than classification.

Guest: Can you comment on overlap on science and technology development and objectives.

Abell: There will be a huge amount of overlap. We're going to need more technology and instrument development. The objectives for human exploration are going to be different from the science objectives.

Tony Farnham- University of Maryland

EPOXI Results and future proposals for the spacecraft (DIXI side)

- Most of the work done by Micah Hearn and the rest of the team
- Science paper to be published at the end of the month

    - Deep Impact Spacecraft launched on July 4, 2005
        - MRI camera and other technology used
        - Smooth patches observed on Comet Temple I- no explanation yet
        - Craters also observed and layers
        - Over a dozen outbursts on comet
        - Coma observations
            - Dust spikes
            - Spectral scans gave a spatial map
            - CO2 stronger where the dust was strong, water where the sun was
            - Jets coming from the smooth patch
    - Two top level goal in DIXI proposals
        - Explore cometary diversity
        - Determine which discoveries are common or result of evolution vs. primordial
        - Numerous detailed goals
    - Hartley 2 vs. Tempel I
    - Approach and Departure
    - Approach-CN Gas production
    - Approach- Gas behavior
    - Gas variability (photometry)
    - Encounter
    - Movie: Flying under the comet
        - Project I'm working on are the "donuts"/ speckles in the coma of Hartley 2
        - Also studying how the particles are moving.
    - Gasses in the coma of Hartley 2
        - CO2
        - H2O
    - Ice in the coma of Hartley 2
    - Comparisons to Temple I
        - Water Ice on Temple I
        - Water Ice on Temple I Ejecta
        - Hartley 2 has many more CO2 jets than Temple I
    - DI Future Prospects

Guest: We heard a lot of uncertainties. What sort of technologies would you use in the future to address these?

Farnham: If I had my druthers, I would land on the comet. We don't know how deep the ice is, the thermal inertia, how deep the CO2 is, etc....

Guest: A thermophysical map would help with some of that.

Farnham: We need to know more of what's inside of the comet, the primordial record. Each one is unique.

Mike Zolensky and Paul Abell

Hayabusa results and plans for Hyabusa 2- Zolensky

- Re-entry June 13th at midnight
- Thought that Australia was better than Utah
- More than 10,000 grains of asteroid collected
- Sample transfer will be in the Fall-Winter 2011
- Handled at the Cosmic Dust Lab
- NASA's samples will be available by January 2012
- Contingency samples might not be necessary
- The funding will come from Curation
- Thursday at the LPFC conference will be about Hayabusa

Guest: How did the grain size in the capsule compare with what was observed on the comet?

Zolensky: It's hard to know how they correlate because we were unable to land. We only collected dust by static. It looks as though it was an LL or LL-5.

Guest: A lot of the particles could be inhaled into the lung. Is there any study on the effects?

Zolensky: You're right, not much has been done in that area.

Outline of Hayabusa- Abell

- Finished in 2010
- Hayabusa 2 has been approved
- The purpose of Hayabusa 2
  - Science
  - Engineering
  - Exploration
  - Primitive Body Exploration Program considered in Japan
  - Several types of asteroid
- Hayabusa 2 will launch in July 2014 and return December 2020 to Australia
- Mission Scenario
- Hyabusa 2 spacecraft

- Target Asteroid
- International Collaborations up to now
- Project Milestones

Guest: Do we know when Hyabusa 2 will be fully approved?

Abell: It's officially approved and will begin April 2011.

Sykes: I appreciate all of your participation. It's been great hearing both about the technology as well as the road map. We'll have our SBAG-5 in August.

Johnson: Marco Polo R and Hyabusa will both be international collaboration. We are looking at an add-on proposal from Andy Chan. Refer to him on how to be involved.

We're always interested in your ideas. The best way for NASA to hear about ideas is from you ahead of time, the planning, as soon as you are able. Then, we're better able to sponsor.

Sykes: I just returned from PSF, who are concerned about the budget. Let's plan to share resources. $120 Million increase over last year's budget. So, we have about a 10% decrease from last year. Congress is talking about another 5% cut from last year.

MSL needs another $82.2 million. $23.3 million from current fiscal year. There will be an answer this summer. Most other things will be on hold until March 4th, this year.

Johnson: We're all on wait and see mode. In the decadal survey, I hope some people will stay plugged in. It's not as heavy on small bodies.

End of Day 3