OPAG Meeting Report
November 7-8th 2006

The Outer Planets Assessment Group is a NASA-supported forum for scientists and engineers to discuss exploration of the outer solar system and to enhance communication between community and NASA.

In July 2006 OPAG produced a report, *Scientific Goals and Pathways for Exploration of the Outer Solar System,* which describes the scientific priorities for exploring the outer solar system. The 35-page document is available at the OPAG website (http://www.lpi.usra.edu/opag/pathways_07_06.pdf). The report presents findings which describe the views of the scientific community, as represented by OPAG, on policy issues related to the outer solar system.

The meeting of OPAG held at the Tucson Sheraton, Tucson, AZ and was attended by 80 people. We heard presentations as follows (not necessarily in order):

- Solar System Division Overview – Jim Green (NASA HQ)
- Cassini status – Dennis Matson (JPL)
- New Horizons status – Alan Stern, PI, (SWRI)
- Juno status – Randy Gladstone (SWRI)
- Uranus at Equinox workshop – Mark Hofstadter (JPL)
- Enceladus Focus Group – Carolyn Porco (SSI)
- Atmospheric Probes workshop – Sushil Atraya (U Michigan)
- Radioisotope Power Systems – Steve Johnson (Idaho Nat. Lab)
- Titan and Enceladus mission feasibility study – Kim Reh (JPL), Hunter Waite (SWRI), John Spencer (SWRI)
- NASA Academy Enceladus Study - R. Anderson (Cornell U), D. Calvo (USC)
- NASA's Planetary System Science Management Operations Working Group Steve Larson (U Arizona)
- Outer Planets R&A programs – Curt Niebur (NASA HQ)

We also heard science presentations from Caitlin Griffith (U Arizona) on Titan, Bill Hubbard (U of Arizona) on Extra-Solar Planet Atmospheres, and Paul Schenk (LPI) on Chronology of the Solar System.

Flagship Missions

OPAG enthusiastically received Jim Green's announcement that NASA HQ plans to implement Science and Technology Definition Teams (STDTs) to study flagship missions to icy moons, specifically Europa, Titan, Enceladus and Ganymede. Such mission studies have been a major priority of OPAG:

> *Finding 3: Mission Studies – OPAG encourages NASA to begin comprehensive mission studies toward destinations in the outer solar system in order to assess the technical feasibility, realistic cost and time frame of viable missions. OPAG affirms the findings of the Decadal Survey, COMPLEX, and SSES, that Europa is the top-priority science destination in the outer solar system. Titan and Enceladus are also*

*important science destinations and OPAG urges NASA to evaluate potential missions to these targets. (*Pathways document, p.2)

It must be recognized that the scientific goals and potential mission concepts for these additional objects are not as mature as those for Europa. We note that the addition of Ganymede to the list accommodates interests of scientists in Europe and that a mission to Ganymede may address broader goals of the jovian system.

OPAG supports the approach to these STDTs proposed by NASA HQ, consistent with OPAG's findings:

> *Recognizing the recent trends of escalating costs of large missions within NASA's SMD, OPAG advocates that all studies of missions involve scientists working closely with mission engineers and that these studies must be subject to a review of technical, management and cost by an independent body. OPAG is concerned that any delays and/or cost over-runs of the next flagship mission might jeopardize the long-term goals for scientific exploration of the outer solar system.* (Pathways document p.16)
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> *To inform decisions about a future flagship mission, concept studies of outer planet flagship missions must be with sufficient fidelity to ascertain whether missions realistically fit into a "flagship box" of a set timeframe (e.g. 15 years) and a set total mission cost (e.g. $2.5B).* (Pathways document p.19)

To provide the necessary information for NASA to decide on the next flagship to the outer solar system such STDTs should:

(i) Comprise a team of scientists working close with mission engineers
(ii) Be funded adequately to complete studies to sufficient depth to allow NASA to accurately evaluate the viability of each mission
(iii) Report scientific goals, technical feasibility, management structure and mission costs which will be reviewed by an independent body
(iv) Complete all reports by a set deadline (e.g. 9 months)
(v) Take full advantage of national engineering and scientific resources by NASA assigning leadership of the studies to different institutions (with the expectation that organizations will pool/share their unique expertise as required).

New Frontiers Program

OPAG supports an AO for the 3rd New Frontiers mission (NF3) in the 2008 timeframe and encourages NASA to make the scope of the AO broad. OPAG notes that there are several targets in the outer solar system that might be accommodated with New Frontiers missions and encourages NASA to allow such missions within the next AO for New Frontiers missions. OPAG invites the New Frontiers Program Scientist, Tom Morgan, to brief the next OPAG meeting on plans for NF3.

Small Bodies

OPAG's charter encompasses the whole outer solar system and includes objects of all sizes. Scientists studying small bodies are welcome to OPAG.

Key to understanding the rapidly-increasing inventory of primitive bodies in the solar system is a survey of their diversity. There currently are or have recently been several missions to small bodies – Deep Impact, Stardust, Dawn, New Horizons, Rosetta – suggesting an evaluation of small-body science in light of these missions would be timely and appropriate. To this end, the OPAG primitive body working group is tasked to evaluate what (a) current/planned missions and (b) ground-based studies, are likely to have told us 5-10 years hence. OPAG notes that COMPLEX is chartered to conduct rigorous studies of scientific issues. We urge COMPLEX to consider a study such as described above and to evaluate the outstanding scientific issues. Such a study is vital for assessing the next steps in exploration of primitive bodies of the outer solar system.

Priorities for Technology Development

OPAG's Pathways document lists specific technologies that enable and enhance missions to the outer solar system. At the November meeting we were briefed on the current status of radioisotope power systems, a key component of flagship missions to the outer solar system. Specific findings on technology from the meeting are:

- OPAG welcomes Jim Green's announcement that Alan Harmon will be joining NASA HQ to lead PSS' technology development.
- OPAG appreciates the collaboration with Idaho National Labs and welcomes a report on their spring workshop
- OPAG notes that Stirling Generators offer potential for improved efficiency of power generation and requests a briefing on the progress of their development at the next OPAG meeting.
- Aerocapture is a key technology for some future missions (e.g. Titan orbiter, giant planet orbiters). NASA's Planetary Science Division is urged to inform NASA's technology division that testing of aerocapture technologies with the next New Millennium mission is a high priority for outer solar system exploration.
- OPAG reiterates that planetary science missions require reliable communication systems and is highly dependent on maintenance of the Deep Space Network.

OPAG Workshops

OPAG recognizes that there are several topics that would benefit from workshop discussions. The OPAG meetings bring a substantial number of people together and offer an opportunity for workshops to be held a couple of days before or after an OPAG meeting. Potential workshop topics are: small bodies, planetary atmospheres, instrumentation, chronology of the solar system, proposal writing, laboratory activities in support of outer solar system exploration.

Next Meeting

- Dates tentatively set for May 1-2nd, 2007 in the Boston area.
- The fall 2007 meeting will probably be near APL, Laurel, MD.

The OPAG Steering Group is posted on the OPAG website and is rotated on ~3 year basis – see http://www.lpi.usra.edu/opag/