

Outer Planets Assessment Group
March 9-10, 2009 Meeting
Bethesda, Maryland

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

The meeting of OPAG held in Bethesda, Maryland, was attended by ~75 people. We heard presentations as follows:

- Planetary Science Subcommittee (PSS) Report – Fran Bagenal (UC Boulder)
- Planetary Science Division (PSD) Update – James Green (NASA HQ)
- Outer Planets Flagship Mission – Curt Niebur (NASA HQ)
- Planetary Science Decadal Survey 2009-2011 – David Smith (NRC)
- OPAG DS White Paper – William McKinnon (Washington Univ)
- Proposed Cassini XXM Mission – Robert Pappalardo & Linda Spilker (JPL)
- Cassini Data Usability: A Midterm Assessment – Claudia Alexander (JPL)
- Planetary Research – Phil Crane (NASA HQ)
- Galilean Satellite Globes Update – David Williams (ASU)
- Solar Uranus Mission – Mark Hofstadter (JPL)
- Io Volcano Observer – Alfred McEwen (LPL/UA)
- Titan Mare Explorer – Ellen Stofan (Proxemy)
- Europa Lander Workshop – Kevin Hand (JPL)
- ESA Outer Planet Plans in 2009-2010 – Christian Erd (ESA)
- Community Participation in EJSM/Proposed Interim Science Plan – Ron Greeley (ASU)
- Fast Access Spacecraft Testbed – Mike Kaplan (Boeing)

Almost all of these presentations are available at the OPAG website:
<http://www.lpi.usra.edu/opag/reports.html>

This meeting marked the operational end of Fran Bagenal's chairship of OPAG. As OPAG's first chair, she helped to initiate and guide the community through two rounds of Outer Planet Flagship studies. She has set a very high bar for all future chairs. Well done Fran!

Two major issues were the primary focus of most OPAG discussions at this meeting. First, the announced prioritization of the Outer Planets Flagship sequence, with the Europa Jupiter System Mission (EJSM) to come first, represents a victory for the entire outer planets community, which worked extraordinarily hard to see such a mission come to fruition. There nevertheless remains a great deal of work to be done to synchronize mission development with our European colleagues, and to reduce technical and cost risk, all of which will be challenging in the fiscal environment created by the Mars Science Lander (MSL) launch delay, and of course, by the larger economic situation. The second

major issue concerns the Planetary Science Decadal Survey, which gets underway this summer, and to which OPAG intends to submit a consensus white paper. We will return to these issues in greater detail in our findings below.

At the conclusion of the meeting OPAG made the following findings:

1. Outer Planet Flagship. OPAG lauds NASA's prioritization of the Outer Planets Flagship missions that underwent detailed independent scientific, technical, management, and cost review in December 2008. The first priority for development and launch in the Europa Jupiter System Mission (EJSM), comprised of a NASA *Jupiter Europa Orbiter* (JEO) and an ESA *Jupiter Ganymede Orbiter* (JGO); a *Jupiter Magnetospheric Orbiter* (JMO) is also being considered by the Japan Aerospace Exploration Agency (JAXA). While the primary focus of JEO is to orbit Europa, the science return encompasses the entire jovian system with flybys of Io, Ganymede, and Callisto, along with ~2.5 years' observing Jupiter's atmosphere, magnetosphere, and rings. Similarly, JGO will investigate Callisto and ultimately orbit Ganymede, and its focused observations of the Jupiter system will complement those of JEO. If it comes to fruition, JAXA's JMO has the potential to focus on particles and fields observations of the jovian magnetosphere. While JEO and JGO are complementary and potentially synergistic, both are designed as "stand-alone" missions as a contingency.

To align US and European development schedules (JGO is still in competition in ESA's Cosmic Visions program), and help support the costs of the MSL launch delay, JEO is not planned for a phase A new start until FY2011. This does not obviate the need for further technology and instrument development, and negotiation of the potential partnership with ESA, in the interim. Despite the demands of MSL, **OPAG vigorously encourages NASA to do its utmost to continue preparations for the JEO mission, including support for instrument development, continued international collaboration, and reduction of radiation risk, and culminating as soon as practical in a new start.** In particular, OPAG endorses the "scientific pyramid" approach described by Ron Greeley for providing near-term advice for ESJM.

2. Outer Planet Flagship Line. The scientific case for a return to Titan is undiminished, but elements of risk to cost, schedule and science were cited in the recent review of the potential flagship mission to Titan (TSSM). OPAG strongly endorses the concept of a sequence, or line, of flagship missions to the outer Solar System, and it is a broadly held view in the outer planets community that the next large flagship class mission, after ESJM, should be to Titan and the Saturn system. OPAG recognizes that the Decadal Survey (discussed below) is designed specifically to prioritize among missions and targets, but it would be disingenuous to ignore the work to date and scientific interest in Titan exploration. To that end, **OPAG recommends that NASA develop a program to reduce or retire technological or other risk associated with a major mission to Titan, which may include such enhancing technologies as aerocapture, as well as maintain a science working group of the appropriate size to provide advice and input for such a program.**

3. New Frontiers Program. OPAG lauds the release of the Announcement of Opportunity (AO) for New Frontiers 3. Reiterating our report from November, 2008, we recommend that NASA establish a mechanism to update the mission list for future New Frontiers AOs. In the near-term, we note with concern that one of the solutions to the budgetary needs of MSL was to re-program the headquarters held reserve for Juno (NF2). While the Juno project has concurred with this re-programming, it is nevertheless conceivable that Juno will eventually need some or all of these reserves. **OPAG strongly encourages NASA to maintain Juno on its current schedule, and to mitigate any potential delay to the mission should unforeseen circumstances arise that require expenditure of what would have been mission reserve funds.**

4. Small Flagship Missions. There was some discussion of the cost gap between New Frontiers class and large Flagship class missions (this cost gap may approach \$2B), and the scientific utility of “smaller,” focused but still Flagship-class missions to the outer planets, such as probe missions. **OPAG recommends that NASA evaluate the possibility of having a new mission class above New Frontiers, but less costly than Cassini, JEO, or Mars Sample Return, for example.** Such a new mission class should not be so costly as to preclude consideration except on a decadal time scale (or more), which appears to be how major or “large” Flagship-class missions are being implemented in reality. Small Flagship missions would have obvious benefits for exploration of the entire Solar System, not just the outer planets.

5. Planetary Science Decadal Survey. The Decadal Survey (DS) represents an opportunity for the entire planetary community to organize and prioritize its science, exploration and mission goals. It is also an opportunity for the outer planets community to consider goals and mission balance among an incredibly rich and diverse suite of scientific targets. OPAG will be gathering input for a synthesis white paper, for submission to the Decadal Survey panels this summer, and **OPAG encourages interested members of the outer planets community to craft their own, topical white papers, and forward them or summaries thereof to the OPAG Steering Committee.** OPAG will also be in cooperative communication with the other AGs, especially the Small Bodies Assessment Group, which has purview over the icy dwarf planets of the Kuiper belt.

Part of the validation of any decadal strategy will be assessment of cost and risk of possible missions. OPAG recognizes that time is limited and resources are constrained, but **OPAG urges NASA to support NRC mission studies as part of the DS to whatever extent practical.**

6. Radioisotope and Other Power Systems. As in previous OPAG findings, we reiterate the central importance of radioisotope power systems to deep space exploration, and **OPAG strongly encourages all relevant governmental agencies to explore innovative ways to make sufficient plutonium available for future outer planets missions (after JEO).** We laud the planned availability of Stirling (ASRG) power sources in the upcoming Discovery 13 AO. A long-term ASRG flight test is critically important for future exploration at Saturn and beyond, and it would be a good example of enabling a critical technology (e.g., aerocapture for bodies with atmospheres).

Technological development of enhanced solar power systems is also strongly encouraged.

7. Cassini Extended-Extended Mission (XXM). OPAG heard a detailed description of the proposed 7-year Cassini XXM, which would last until Saturn solstice, and include a Juno-like end-of-mission scenario. The goals of the XXM include observing seasonal and temporal change in the Saturn system to understand underlying processes, addressing new discoveries and preparing for future missions. Given the cost savings proposed, and the rich scientific harvest promised, **OPAG strongly endorses approval by NASA of this extension to the Cassini mission, including the Juno-like end-of-mission scenario.**

As in previous findings, OPAG encourages NASA to broaden community participation in this long-running, and incredibly productive, endeavor, for example by competing a new selection of Interdisciplinary Scientists. This would be generally seen as a positive development by the outer planets community. Thus, **OPAG reiterates the need to involve new members of the outer planets community in the Cassini science teams, to facilitate interdisciplinary science and to train the next generation of outer planet scientists in an active planetary mission.**

8. Data Usability. The Planetary Data System (PDS) is a greatly valued resource for the entire planetary community. OPAG endorses the notion that community use of data from a flagship mission such as Cassini should be encouraged and facilitated to the extent practical, and applauds efforts by Cassini teams to facilitate data usage for community users, and PDS for the archiving and dissemination of software and higher level data products from this effort. OPAG recognizes that many different data types involved, and further recommends that the community take advantage of user guides and practice user realism. **OPAG recognizes the need for PDS to improve its overarching tools for archiving and retrieval of mission data and ancillary files for all missions under its purview and suggests that NASA address the implementation of this strategy at PDS.** This may include better tools for data display and observational geometry visualization, as well as mechanisms to make user supplied software available.

9. Outer Solar System Communication. All discussion of missions such as ESJM and beyond will be moot if NASA loses its capabilities for deep space communication (presently provided by the Deep Space Net). As in previous reports, **OPAG emphasizes that NASA's capabilities for communication with the outer Solar System should not be allowed to atrophy or disappear entirely.**

The next OPAG meeting will be held in Columbia, MD on Tuesday July 14th, in conjunction with the Outer Planets Flagship Instrument Workshop at APL.