

**Outer Planets Assessment/Analysis Group  
February 8–9, 2010 Meeting  
Washington, DC**

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.

OPAG met this winter in the brief interval between two major blizzards that paralyzed the nation's capitol. As such, the nominal two-day meeting was started at noon on the first day to allow attendees sufficient time to arrive (those coming from overseas, into Dulles, had an easier time than many attempting to fly from the west coast). When it became clear that the second blizzard would rival the first, it was decided to accelerate the schedule to break at noon on the second day. Nonetheless, many were delayed in leaving for an additional 1 to 2 days. It was, however, a productive meeting, attended by over 40 people initially, dwindling towards the end, and with a large number listening in or participating through Webex. Snow and ice are hardly an anathema to devotees of the outer solar system. We heard presentations as follows:

- Planetary Science Division (PSD) Update – James Green (NASA HQ)
- Outer Planets Program (OPP) Update – Curt Niebur (NASA HQ)
- Planetary Science Subcommittee (PSS) Report – Fran Bagenal (UC Boulder)
- Planetary Science Decadal Survey – Heidi Hammel (SSI) & John Spencer (SwRI)
- Future Titan Exploration – Ralph Lorenz (APL)
- Titan's Lakes (Science Talk) – Alex Hayes (Caltech)
- Report from Joint NASA-ESA OPF JSDT – Bob Pappalardo (JPL) & Olivier Grasset (Univ. Nantes)
- Synergistic Magnetospheric Science with More than One Spacecraft – Norbert Krupp (MPI)
- EJSJ Jupiter Science – Amy Simon-Miller (GRC), Leigh Fletcher (Oxford), & Bob Pappalardo (JPL)
- ESJM Satellite Tour Assessment – David Senske (JPL), Robert Lock (JPL) & Olivier Grasset (Univ. Nantes)
- EJSJ General Science and Discussion – Bob Pappalardo (JPL) & Ron Greeley (ASU)
- Outer Planets Program Future Directions – C. Niebur (NASA HQ)

## 1) Europa Jupiter System Mission

The main focus of the meeting, after digesting the various informational reports, was to present in a community-wide forum, the substantial work of the of the NASA-ESA Joint Science Definition Team (JSDT) for the Europa Jupiter System mission – the next large, flagship-class mission to the Outer Solar System. This mission, chosen by NASA as the result of two competitive scientific, technical, and management review cycles, is OPAG's number one priority for a major new undertaking. OPAG submitted a white paper to the Planetary Science Decadal Survey that described the outer planet community's priorities and strongly supported this prioritization: Europa is a world of fundamental planetological and astrobiological interest and importance.

OPAG's strong support for the NASA part of EJSM, the Jupiter Europa Orbiter, is also consistent with the original flagship recommendation in the National Research Council's (NRC's) 2003-2013 solar system exploration decadal survey, *New Frontiers in the Solar System*, and the re-recommendation in the 2007-2008 NRC Committee on Assessing the Solar System Exploration Program, *Grading NASA's Solar System Exploration Program: A Midterm Review*. Flagship-class missions to Europa and Titan were subsequently reviewed, as noted above, and ranked equal in terms of science, but a mission to Europa was ultimately chosen based on technical readiness.

**OPAG strongly supports the joint NASA-ESA mission to the Jupiter system, and urges a timely entry into phase A for the NASA component of EJSM, the Jupiter Europa Orbiter (JEO). OPAG eagerly awaits release of the Announcement of Opportunity (AO) for JEO instrumentation, is looking forward to the July 2010 Instrument Workshop, and strongly encourages NASA to maintain the schedule for the AO release (spring 2011).**

The JSDT report will be finished this calendar year, and the intent of the OPAG presentations was to make sure that the nearly final details were broadly distributed to the outer planets community, and most importantly, that input and reaction from the community could be incorporated in the final report. Because of the adverse weather situation, this feedback was probably not as complete as JSDT members had hoped, but a number of important points were discussed.

## 2) FY11 NASA SMD Budget

It is worth backing up at this point for some general context. Both Jim Green and Curt Niebur outlined the new plan for the Planetary Science Division at NASA. Despite enormous media attention to the proposed changes to human exploration,

relatively little media or other attention has been directed toward NASA's science plans. From OPAG's perspective, the outlook for Planetary Science seems particularly good, with modest but important budget increases for FY10 and FY11. In particular, there is support for JEO in this two FYs, sufficient support to produce an instrument AO, and to start phase A. However, and this was stressed, there is not sufficient budget flexibility in the out years to address the requirements for JEO. This ostensibly would greatly benefit from endorsement by the Planetary Science Decadal Survey, but it is unclear how all the competing priorities for major missions will play out in the Survey. OPAG was deeply gratified to see that the Cassini Extended-Extended (or Solstice) Mission was formally approved, which will allow for exciting new scientific results to continue to pour forth from the Saturn system until 2017.

**Overall, OPAG and the outer planets community in general strongly support the President's proposed FY11 budget for Planetary Science.** In addition, OPAG recognizes with gratitude the hard work at NASA HQ necessary to craft a realistic, exciting, and executable science program.

### **3) Plutonium Shortage**

As in previous OPAG findings, we reiterate the central importance of radioisotope power systems to deep space exploration. We laud the planned availability of Advanced Stirling Radioisotope Generators (ASRG) power sources in the upcoming (now released) Discovery AO. We are greatly encouraged by the detailed analysis in the 2009 NRC McNutt et al. report (*Radioisotope Power Systems: An Imperative for Maintaining U.S. Leadership in Space Exploration. National Academies Press, ISBN 0-309-13858-2*), and encourage Congress to act this year to approve restart of domestic 238-Pu production by DOE.

**OPAG continues to strongly encourage all relevant governmental agencies to explore ways to make sufficient plutonium available for future outer planets (and other) missions. OPAG also strongly supports, in general, NASA providing as GFE technology needing development for outer planets New Frontiers or Discovery missions.**

### **4) Supporting Research & Technology (SR&T) Working Group**

The Planetary Science Subcommittee has recommended that a team of PSS members, spanning a cross-section of the scientific community, form an SR&T Working Group to evaluate all SR&T programs within the PSD, and to provide advice

to NASA on priorities for their support within the SR&T programs.

The SR&T Working Group will be very important for supporting the evaluation of R&A programs (e.g., re-balancing between programs – OPAG notes the recent low acceptance rate 17% for Outer Planets Research), as well as for evaluating funding for mission science within missions (the DA in MO & DA) vs. supporting mission science with R&A programs (as the latter often occurs as mission resources become tight).

In addition, long-duration missions are a hallmark of outer planets exploration, and significant and substantial issues surround 1) the duration of NASA's commitment to Co-Is, 2) heritability and transference of mission roles, and 3) pathways to bring new generations of scientists into such missions in meaningful ways. (See also finding #9, below.)

**OPAG supports PSS in evaluating SR&T. OPAG further recommends that the PS SR&T Working Group evaluate the role of Co-Is/Interdisciplinary Scientists/Participating Scientists on long-duration missions (such as Cassini) and provide recommendations for future long-duration missions such as the next Outer Planets Flagship.**

## **5) Technology Panel**

Technology issues are naturally crucial to all of the PSD, but they assume particular importance for the Outer Planets given the often demanding and unique environments in the Outer Solar System (for example, the cold, dense atmosphere of Titan, or the radiation environment at Europa). The growing cost of Outer Planet missions can limit scientific productivity – new technology is needed to control the cost of these missions – i.e., it is not just a good thing to have, it may be crucial to Outer Planets survival as a healthy discipline.

Technology issues and recommendations were highlighted in OPAG's white paper contributions to the DS. The Planetary Science Subcommittee has supported the formation of a panel to assess technology development projects within the PSD, to develop a coordinated and integrated technology development plan, and to recommend process and policy changes to improve effectiveness and performance. OPAG understands that the Technology Panel is already underway and has outer planet representation.

**OPAG strongly supports the PSD in setting up the Technology Panel.** In terms

of the distribution of resources, **OPAG emphasizes need to balance evaluating technologies that could be brought up to flight Technical Readiness Levels (TRL) on OPF or close-term missions vs. developing lower TRL technologies to enable more future missions.**

## **6) Future Titan Exploration Technologies**

Titan exploration remains a top priority for the Outer Planets community, both by means of continued Cassini operations at Saturn, and through planning for a second major outer planets mission (future flagship) or nearer-term missions (e.g., New Frontiers or Discovery class) to the Saturn system.

**OPAG emphasizes support for continuing technology development to enable future Titan exploration (e.g., the Montgolfière).** Given European interest and experience with Titan exploration (e.g., Huygens), **OPAG emphasizes the advantages of coordination with our international partners.**

## **7) Outer Planet Flagship Science Review Board**

OPAG was especially impressed with the NASA-ESA JSDT presentations on greatly enhanced opportunities for Jupiter science, and for synergistic magnetospheric science from two platforms (JEO and JGO), for EJSM. These opportunities are reflected in the new traceability matrix (linked on the OPAG website). The JSDT has been functioning so well that it was felt that continuing and similar science advice and input would be valuable as the OPF mission develops—even after formal submission of the JSDT report.

**OPAG recommends that NASA include a strong science component as part of the standard independent review process that missions undergo throughout formulation and development. This could take the form of an ongoing Science Review Board or science representation on existing review boards. This science review process is especially critical between the time that the JSDT formally dissolves and a Project Science Group can be formed. Such a Science Board, or suitable representation, may be valuable even after PSG formation**

## **8) OPAG and OP community recommendations and comments to the JSDT**

OPAG heard a number of community ideas and concerns regarding the JSDT recommendations. Among the topics discussed were Io science opportunities, wavelength ranges for jovian science, strategies for time variability data acquisition,

and the relation of EJSM to JUNO and exoplanet research.

**OPAG is most pleased and encouraged by the jovian tour phase science opportunities of ESJM, and wishes to see these science opportunities maximized. More broadly, OPAG recommends that EJSM have a way to evaluate science accomplishments and priorities as the mission proceeds, given the mission's likely multi-year life.**

#### **9) Broadening Community Involvement in Cassini.**

OPAG continues to be concerned about broadening scientific involvement in the ongoing Cassini mission, not strictly data analysis through the PDS. OPAG understands the constraints imposed on the Cassini Solstice Mission that has recently been approved (and which we laud in no uncertain terms!), but if funding could be obtained, it would be of great benefit to create a path to augment (not simply replace) Cassini investigators. The importance and benefits of broadening involvement should be self-evident, but include bringing fresher and different perspectives to all phases of the mission, from science prioritization and encounter planning, to data analysis and archiving, to public outreach. There was, after all, an initial plan for a Cassini Participating Scientist program, but this was eliminated early-on to reduce costs.

**OPAG recommends that NASA continue to seek pathways to broaden community involvement with the Cassini mission beyond the original investigators and their research associates. It would be especially valuable if younger members of the outer planets community had opportunities to join Cassini science teams.**

**The next OPAG meeting will be held Sept 16-17 in Boulder, CO.**