OPAG Assessment of Decadal Survey – Top Level Findings

Finding #1 — OPAG endorses the decadal survey, *Visions and Voyages for Planetary Science in the Decade 2013-2022 (V&V)*, and its implications for future missions, research & infrastructure, and technology development.

OPAG strongly endorses the over-arching premise of V&V that a vibrant planetary program requires frequent access to space and a diversity of missions and scientific objectives. OPAG also recognizes that many scientific disciplines participate in planetary exploration. Thus a planetary program implemented within resource constraints must not abandon a multiplicity of missions, scientific objectives, and solar system objects. OPAG recognizes that the current budget situation is different than that envisioned by V&V, and urges NASA to work in an open manner with the community via PSS and the AGs as it rebalances the PSD portfolio to implement V&V.

OPAG endorses a program that includes a mix of PI-class Discovery and New Frontier missions, as well as more capable, but less frequent, Flagship missions, to multiple destinations in the solar system.

OPAG encourages NASA to develop a comprehensive framework for its flagship decision process, including decision timelines, technical readiness, independent STMC (Science, Technical, Management, and Cost) reviews, resource requirements, and schedule.

OPAG requests a briefing about the framework for the flagship decision process at our next meeting in the fall of 2011.

Finding #2 — OPAG strongly urges continued NASA investment in a variety of mission concept studies and their independent review.

As demonstrated by the Decadal process and the Outer Planet Flagship study effort, NASA investment in mission concept studies is beneficial in improving the readiness of mission concepts and in aiding the decision process. However, to the extent possible, such investment should apply a common study framework, including common groundrules, study outputs, and non-advocate evaluation methodology. Mission concept studies should begin with the top flagship priorities listed in V&V: Mars, Europa, and Uranus.

Flagships are critical for outer solar system exploration. OPAG lauds the selection of two

potential strategic missions to the Outer Solar System, in priority order from V&V: Jupiter Europa Orbiter, and Uranus Orbiter with Probe. OPAG recognizes that current budgetary constraints require reductions to the scope and cost of such ambitious missions, if flagship missions are to be achieved in the near future.

OPAG strongly urges mission studies for the flagship priorities listed below.

1) A redesigned Jupiter-Europa mission. V&V stated that "The Europa Geophysical Explorer, from which the JEO [Jupiter Europa Orbiter] concept is derived, was the one Flagship mission recommended in the previous planetary decadal survey. The scientific case for this mission was compelling then, and it remains compelling now." V&V concludes that "The second highest priority Flagship mission for the decade 2013-2022 is JEO. However, its cost as currently designed is so high that both a decrease in mission scope and cost … are necessary to make it affordable" and that "NASA should immediately undertake an effort to find major cost reductions for JEO..."

OPAG strongly urges that studies of a descoped Jupiter-Europa mission be initiated very soon and completed in a timely fashion, with coordinated inputs from the science community.

2) A Uranus Orbiter with Probe mission. OPAG endorses the Uranus flagship mission proposed by the Decadal Survey. This will be our first detailed look at an Ice Giant, its magnetosphere, and its system of satellites and rings. Unlike the rocky terrestrial planets or the gas giants composed mostly of hydrogen (Jupiter and Saturn), we know very little about the properties of the ice giants. A mission to Uranus offers enormous potential for new discoveries. We encourage NASA to undertake more detailed Uranus mission studies. The insights gained into the science goals, measurement objectives, instruments, and trajectories will help assure a successful, well-costed mission.

OPAG encourages NASA to undertake Uranus mission studies in the near future.

Finding #3 — OPAG strongly endorses the V&V recommendation that NASA vigorously pursue international cooperation in planning and executing planetary missions in the Outer Solar System. OPAG fully endorses the ESA Jupiter Ganymede Orbiter (JGO) mission concept.

OPAG acknowledges missions under study in Europe that are synergistic with proposed US missions, and recognizes that international collaborations have led to incredibly fruitful results. Exploration of Ganymede in particular has strong potential for collaboration with Europe, as well as the potential to return important Jupiter system and icy satellite science.

Ganymede possesses an intrinsic magnetic field, diverse geology, and a probable subsurface ocean. The Planetary Science Decadal Survey identifies Ganymede as an important object to study, addressing the theme of Building New Worlds. The *ESA Jupiter Ganymede Orbiter (JGO)* mission would characterize Ganymede as a planetary object, including its potential habitability, as described in the 2010 Joint Jupiter Science Definition Team reports to NASA and ESA. JGO was designed to fly along with the NASA Jupiter Europa Orbiter (JEO) as part of the Europa Jupiter Science Mission (EJSM), but JGO is in itself an outstanding standalone mission.

OPAG fully endorses the ESA JGO mission concept and PSD's commitment to contribute instruments. OPAG encourages continued collaboration between NASA and ESA as well as the US and European scientific communities during the extended study phase for JGO.

Finding #4 — OPAG laments that no future Titan mission was included in the V&V as a potential mission at any level for the coming decade. OPAG urges that NASA consider how technology improvements could enable future exploration of this V&V priority.

V&V states that "Further exploration of Titan is a very high priority for satellite science." V&V further states that the proposed Titan Saturn System Mission concept "has the highest priority among the deferred missions to the satellites of the outer planets." V&V concludes that "technology investments must be made in the decade 2013-2022 in order to enable this mission and reduce its cost and risk." OPAG judges that Titan science, mission concepts, and technology needs should be reassessed in light of V&V's findings and the current budget environment.

OPAG concludes that technology and study investments should be guided by this reassessment and made in the coming decade to enable Titan exploration.

Finding #5 — OPAG endorses the Technology recommendations in V&V, and specifically urges a technology effort over a range of planning horizons.

OPAG suggests an early comprehensive technology planning effort to ensure that both competed and flagship missions recommended in the report can be achieved. This long range planning effort should be followed by implementing a well-balanced technology development program that, as advocated in V&V, looks to the next decade as well as this one. For the outer planets, it is clear that a well thought-out plan to address power, propulsion, communication, probe technologies and instrument needs is critical.

Finding #6 — OPAG vigorously supports the V&V recommendation for a restart of domestic plutonium-238 (Pu-238) production.

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V&V states that "Without a restart of plutonium-238 production, it will be impossible for the United States… to conduct certain important types of planetary missions after this decade." Due to low light levels the outer Solar System, nearly all conceivable missions to destinations beyond Jupiter require some form of Radioisotope Power Source, which requires Pu-238. OPAG also endorses the V&V recommendation that enabling ASRG technology be developed to flight readiness in a timely fashion.

Finding #7 — OPAG urges NASA to pursue non-flagship flight opportunities for outer planets missions.

V&V states that "If NASA wants to explore beyond the orbit of Jupiter, NASA must accept that there are risks associated with that exploration (long timescales, limited power options, etc), and that there are concomitant costs associated with those risks." These risks uniquely place outer planet missions at a competitive disadvantage. Nevertheless, innovative, focused outer planet missions are possible in smaller mission classes. For example, New Horizons is en route to Pluto, Juno will be launched this year, and V&V lists two missions (Saturn Probe and Io Observer) as New Frontiers candidates. In addition, the modified parameters of the recent Discovery AO (offering GFE technologies including ASRG, increasing the cost cap, removing the launch vehicle from the cost cap, etc.) enabled a new class of missions to be competitive in the Discovery program.

OPAG strongly endorses the V&V recommendation "changing the New Frontiers cost cap to $1.0 billion FY2015, excluding launch costs."

OPAG further urges PSD to continue to identify and implement innovative policies to address the unavoidable risks integral to outer planet missions, in order to enable these concepts to compete effectively outside of the flagship mission class.

For the OPAG Steering Committee

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Bill McKinnon, Chair