

Cross-AG IDEA Working Group

co-chairs: Maggie McAdam & Julie Rathbun

1. The EDI WG endorses PAC recommendation 2, 3, and 8 from June.
 - ▶ Suggest the PAC consider moving #8 up to the NAC as requesting an outward facing DEIA position at the SMD level (instead of PSD).
2. We request NASA explore the legality of using diversity (including race, gender, disability, LGBTQ+, etc) of a team as a selection criteria for selecting and extending missions, projects, facilities, and other large teams.
3. We believe Inclusion Plans could be a way to increase EDIA in planetary science. We suggest that NASA work with the community to develop resources (including funding members of the community) to educate the community. This should include education on why inclusion plans are important and best practices for implementation.

Website: <https://www.lpi.usra.edu/exmag/>, Twitter: @ExMAG_community

Membership: We are recruiting for 2023 - Secretary, Meetings Chair, Communications / social media, Subcommittee chairs for Mars, Asteroids, Microparticles subcommittees, At-large members

White papers / analyses: Science Mission Directorate SPD-41 Feedback, ANSGA-2 Feedback

Meetings: Spring 2022 Meeting - Curation & Collections, Fall 2022 Meeting - Decadal Survey, upcoming missions. Moving back to one meeting a year, perhaps in person (modulo the world)

Findings:

- ExMAG continues to encourage NASA to explore a path to permit sample exchange and reciprocal sample loans between NASA and CNSA. This will become even more urgent as China's Chang'E-6 mission will return material from the South Pole-Aitken (SPA) basin. SPA sample return has been the highest priority for the lunar science community in three consecutive Decadal Surveys but there is currently no NASA plan to implement such an activity. Facilitating US scientists working with SPA samples from such a mission would be a uniquely enabling opportunity.
- ANSMET was canceled again in 2022-2023, not because of the pandemic or logistics – but because it was not deemed “critical”. We do not fully understand how “critical” is being defined by NSF. ANSMET cannot change its remit, so how can NASA advocate for ANSMET?
- ExMAG strongly supports IDEAcon recommendations to PAC. ExMAG members participate in the cross-AG IDEA working group and highlight IDEA activities to our membership.

Actions:

- Sample Analysis community is not well integrated into the Planetary Data Ecosystem. Need to understand what repositories are “sanctioned” for preservation of sample data and find pathways (funding) for training and outreach, how to use software, repositories, etc.
- For Sample Return missions, what activities belong under the PI cost cap of the proposers versus NASA's long-term curatorial commitments
- ExMAG is glad to see that the new PSEF program is running, but has concerns about how facilities and personnel will be supported in the long term, and how this program differs from Planetary Major Equipment requests. We will follow up on clarifying to the community.

ExoPAG ongoing & recent activities

- Ongoing activities with the Planetary Science Division: Exoplanets in Our Backyard workshop (Nov. 2-4, 2022) & Planetary Science Advisory Committee meeting (rep.: [L. Schaefer](#))
- Great Observatory Maturation Program (GoMaP) workshop II, 11-13 Oct. (rep.: [B. Mennesson](#) & [M. Bottom](#))
- Cross-PAG SAG on barriers to participation (rep.: [N. Batalha](#)). Cross-AG IDEA working Group (rep.: [E. May](#)), first meeting focused on the state of the profession.
- ExoExplorers Program (rep.: [K. Colon](#) & [N. Batalha](#))
- Science Interest Groups (SIGs) and Study Analysis Groups (SAGs):
 - SIG2 "Exoplanets Demographics", finalizing report (Christiansen & [Meyer](#))
 - SIG3 "Exoplanets Solar System Synergies", on-going (Meadows & Mandt)
 - SAG23 "The Impact of Exo-Zodiacal Dust on Exoplanet Direct Imaging Surveys" ([Debes](#), Rebollido, Hasegawa)

LEAG strongly urges NASA to engage the lunar community actively and continually in the development of the *Integrated Lunar Strategy*


- **Active broader community involvement and cooperation will provide important benefits for NASA, the lunar community, and the advancement of lunar science and exploration goals.**
 - To achieve strong backing and buy-in that is required for both the success of the *Strategy*
 - Development of cohesive and inclusive lunar science community
- **Communicate the scope of the planned lunar strategy and seek community feedback throughout its development.**
 - Broader community input could be useful perspective early from variety of backgrounds
- **Include non-NASA community members actively in the process**
 - Specific Action Team [Precedent: Mars Concurrent Exploration Science Analysis Group (MCE-SAG)]
 - Consultants working directly with *Strategy* development team [Precedent: Artemis III Sci. Def. Team]
- **Include non-NASA community representatives in current mission concept study teams**
 - Build community support for missions
 - Mitigate potential perception of mission centers making decisions based on own interests
 - Build and support an inclusive community



MAPSIT Findings

1. There is a lack of community tools currently available for **landed image processing**
 - MAPSIT encourages NASA to support and fund such software tools
2. Missions with a dedicated **“lead cartographer” role** are more successful than missions without (when target relevant)
 - MAPSIT encourages NASA to include language recommending or requiring this role in future calls (where appropriate)
3. MAPSIT has made the **Geologic Mapping Subcommittee (GEMS)** a standing subcommittee under the leadership of Prof. Jeanette Luna (TN Tech)
 - Has broad community membership to include planetary surfaces across the Solar System; group will meet monthly to discuss issues pertinent to geologic mapping
4. A **Lunar SDI group** has been established following LCD-SAT recommendation
 - <https://psdi.astrogeology.usgs.gov/moon/governance/intro/>

Mars Exploration Program Analysis Group (MEPAG)



- The Psyche IRB report and the PSD response to it are concerning. In addition to uncovering issues at JPL and postponing the VERITAS mission, this situation reveals what may be a wider problem with multiple mission selections, mission monitoring by PSD, and effects on the rest of PSD when missions and centers encounter problems. Does the PSD have plans to evaluate its own processes and consider how to better prepare for and solve problems encountered in the execution of aspirational science/engineering?
- Deep-space communication is a challenge across PSD and particularly at Mars. Given that the next opportunity to launch an orbital Mars mission is no sooner than 2028 (and more likely 2031), there is an urgent need to establish a communications infrastructure plan for Mars, including the ground segment. Comms is a multifaceted issue, including support of current assets, a continuing MEP as described by the Decadal Survey, and long-term support of humans to Mars. MEPAG suggests that an important part of addressing this issue, and bringing orbital comms assets with high-quality science components online efficiently, could be lower cost/size missions.

Summary of MExAG Activities and Finding

- **Goals Document:** On target to finalize in Q1 or Q2 2023
- **Technology Showcase:** Facilitated 3 mission concepts
- **MExAG23:** Feb 1–3, 2023 (virtual)
- **Finding:** MExAG encourages NASA to work with ground-based observatories where it acquires observation time to enact policies that equitably enable Mercury observations.
(Full text of finding in backup)
- **Next:** BepiColombo Mercury Third Flyby on June 20, 2023

OPAG: draft findings from November 15-16 community meeting

- **OPAG strongly supports the Europa Clipper Mission and commends JPL and NASA for working together to make Clipper the highest priority planetary flagship mission as it moves to launch in October 2024.**
 - We thank Lori Glaze and NASA HQ for prioritizing Europa Clipper to preserve schedule margin as instrument deliveries and integration proceed. We are supportive of NASA's efforts to resolve issues regarding Center workforce as highlighted in the Psyche IRB Report to minimize impact to current and future missions.
- **OPAG urges NASA to fund focused studies for Uranus Orbiter and Probe (UOP), to methodically prepare for and clear a path to Phase A. In particular, OPAG encourages NASA to start work in FY23 on the following topics:**
 - Exploration of trajectories and launch capabilities (to arrive at Uranus well before the equinox in 2049);
 - Models to retire the radiation risk environment for close orbits of Uranus;
 - Identification of potential science instruments and performance parameters, including those pertaining to astrobiology and/or ocean worlds exploration as specified in the UOP study science objectives and OWL recommendations.
- **OPAG is strongly supportive of continuing investment in outer planets related R&A programs. OPAG requests the following:**
 - that the Dual Anonymous Peer Review (DAPR) process be expanded to include the technology programs (MatISSE, PICASSO, etc.)
 - that the Precursor Science Investigations for Europa (PSI-E) program be a recurring call (we suggest every 2 years) to support the Europa Clipper mission and to draw in additional science expertise

Summary of significant SBAG issues for the PAC

- Apophis Specific Action Team (SAT) Report released; posted on SBAG site; announced in DPS Newsletter and PEN; presented later today to the PAC and in January at SBAG 28
- Ocean Worlds inter-AG collaborative working group general purpose/guidance captured during meeting of SBAG, OPAG, and NOW chairs; leadership search in process (with SBAG representation)
- Psyche Independent Review Board (IRB) implications are a big concern; will be a topic of discussion at SBAG 28 (January 2023); too soon and without community feedback for SBAG to officially respond; SBAG participated in AG Chair caucus to discuss initial thoughts and begin to formulate a united front
- Code of Conduct for the Steering Committee approved at last SC meeting (SC member signatures in process; to be posted on SBAG website)
- Upcoming SBAG 28 meeting January 24-25, 2023; agenda being finalized; Early Career recipients selected and notified (2 invited talks, 5 lightning talks)
- High priority findings from SBAG 27 were elevated and presented at the last PAC meeting (June 2022); will undoubtedly continue to be concerns for SBAG community (national resources for planetary radar capabilities and timely fulfillment of the George E. Brown Congressional goal of discovering 90% of the near-Earth asteroid (NEA) population larger than 140 meters in size with NEO Surveyor)

20th Meeting of the Venus
Exploration Analysis Group
Nov 7-9, 2022
Albuquerque NM

VEXAG

300+ registered, 70+ In person
attendees, 90+ Online at once.

FINDINGS (Advanced Draft)

- **VERITAS needs to be launched as soon as possible, without any further delay.** VEXAG suggests that VERITAS be prioritized over solicitation of new proposals, particularly for the same mission class.
- A “**Precursor Science Investigations – Discovery**” (**PSI-D**) **R&A program**, focused on ensuring success of and maximum scientific return from upcoming Discovery missions and the EnVision partnership, is in the interests of the broad planetary community.
- A new “**CloudTech**” **R&A program** to focus on aerial/airborne technologies and implementations applicable to multiple planetary targets, in addition to a **HOTTech 3 program**, in an upcoming ROSES cycle would allow focus on maturing important technologies and integration into platforms and systems.

More details, including Endorsements and Questions, in supplementary slide deck.



VEXAG

- THE AG CAUCUS IS DEEPLY DISAPPOINTED THAT PROBLEMS ON THE PSYCHE MISSION HAVE RESULTED IN THE DELAY OF VERITAS AND STRONGLY SUPPORTS THE LAUNCH OF VERITAS ON ITS NEW SCHEDULE. SHOULD BUDGET BE THE RATE-DETERMINING STEP, NASA SHOULD FOLLOW THE OWL GUIDELINES FOR BUDGETARY DECISIONS.
- THE ISSUES REVEALED BY THE PSYCHE IRB ILLUMINATE WHAT MAY BE A SYSTEMIC PROBLEM WITH HOW MISSIONS ARE SELECTED, FUNDED AND MONITORED THROUGH EVERY PHASE. GIVEN THE TIMING OF THE RELEASE OF THE IRB REPORT, THE AGS ARE PRESENTING AND DISCUSSING THE RESULTS WITH THEIR RESPECTIVE COMMUNITIES, AND WILL REPORT AG-SPECIFIC FINDINGS TO THE PAC AT ITS NEXT MEETING.

Backup



Cross-AG IDEA WG

Cross-AG IDEA Working Group PAC Presentation December 6, 2022

IDEA WG Co-Chairs: Maggie McAdam¹ & Julie Rathbun²

¹NASA Ames Research Center,

²Planetary Science Institute

Website: <https://www.lpi.usra.edu/idea/working-group/>

Decadal Survey suggestion

- ▶ Now that several Decadal Survey's have included a task to survey the state of the profession (including Astro 2010, Astro 2020, Planetary 2023, Helio 2025), we suggest that NASA review the best practices in implementing such a survey. For example, there were many lessons learned between the 2010 and 2020 Astronomy Decadal Surveys, and we should ensure that positive momentum continues throughout all current and future surveys.

Previous PAC Findings (1) - Further information

- ▶ The EDI WG endorses PAC recommendation 2, 3, and 8 from June.
 - ▶ Looking forward to NASA's response
 - ▶ Suggest that the PAC consider moving #8 up to the NAC as requesting an outward facing DEIA position at the SMD level (instead of PSD).
 - ▶ Note that recommendation #1 from “Advancing DEIA in the leadership of competed space missions“ is for the NAC to have a subcommittee on DEIA. Perhaps this rec goes to them too?

Diversity in mission (and other large) teams (2) - further information

- ▶ From 2019 Discovery AO: “NASA recognizes and supports the benefits of having diverse and inclusive scientific, engineering, and technology communities”
- ▶ During the SMD Bridge Program Workshop, Dr. Thomas Zurbuchen, when asked about changing administrations, said “I think it's absolutely important for everybody to understand that we actually talk about a bridge program long before this administration came. The vast majority of the progress has been made in terms of focusing on diversity through anonymous peer review. Really addressing new things. It's not something we came up with with the excitement that is in this particular administration. I just want everybody to understand that I believe and so do others that every one of these activities including the bridge program is about doing the right thing to the benefit of the agency while also opening up doors which should be surely a bipartisan objective.”

Inclusion Plans (3) - longer version of recommendation

- ▶ We believe Inclusion Plans could be a useful way to increase EDIA in planetary science. However, the labor of not only implementing these plans, but also of developing them and gathering relevant resources, needs to be provided by NASA and/or paid to the community. NASA should work with the community to explore ways to develop resources (including funding) to educate the community. This should include education of why inclusion plans are important and ways they could be implemented. Resources also need to even the playing field between PIs who have access to DEIA experts (perhaps thru a University office) and those who do not. Since Inclusion Plans are part of many SMD proposals (not just PSD), perhaps this is another recommendation to raise to the NAC (or NAC DEIA subcommittee, if it has formed).

ExoPAG



Exoplanet Program Analysis Group (ExoPAG) Report to APAC

Ilaria Pascucci (U. Arizona)
Chair, ExoPAG Executive Committee
Laura Schaefer (Stanford)
ExoPAG EC member, PAC representative

December 6, 2022

Exoplanet Program Analysis Group: Terms of Reference



(charted by the Astrophysics Division)

1. Articulate & prioritize science drivers for Exoplanet Exploration Research
2. Evaluate capabilities of potential missions to achieve program goals
3. Evaluate ExEP activities with broad community input
4. Articulate & prioritize new mission technologies
5. Provide findings on all related program activities including:
ground-based observing, theory and modeling programs, laboratory astrophysics,
suborbital investigations, data archiving, community engagement

Iliara Pascucci <i>Chair</i>	The University of Arizona
Natasha Batalha	NASA-Ames
Jacob Bean	The University of Chicago
Michael Bottom	The University of Hawaii
Ofer Cohen	University of Massachusetts Lowell
Knicole Colon	NASA GSFC
John Debes	STScI
Diana Dragomir	University of New Mexico
Erin May	Johns Hopkins Applied Physics Laboratory
Bertrand Mennesson	Jet Propulsion Laboratory/Caltech
Laura Schaefer	Stanford University
John Wisniewski	The University of Oklahoma
Michael Meyer <i>Past Chair, Emeritus</i>	University of Michigan
Hannah Jang-Condell, <i>Executive Secretary, Astrophysics Division</i>	NASA Headquarters
Douglas Hudgins, <i>Program Scientist, Exoplanet Exploration Program</i>	NASA Headquarters
Doris Daou, <i>NASA Planetary Science Division Liaison</i>	NASA Headquarters
Richard Eckman, <i>NASA Earth Science Division Liaison</i>	NASA Headquarters
Galen Fowler, <i>NASA Heliophysics Division Liaison</i>	NASA Headquarters

2022 ExoPAG Executive Committee members

Identified all of the ongoing (and some of the upcoming) activities as well as EC members who could lead them

Thank you to those who volunteered!

ExoPAG ongoing & recent activities I (since the last APAC meeting)

- Organize monthly ExoPAG EC meetings (8/17, 9/21), cross-PAG meetings, rep. to APAC (I. Pascucci)
- Reviewed ExEP Science Gap List (deadline 9/30, all EC members)
- Ongoing activities with the Planetary Science Division: Exoplanets in Our Backyard workshop (Nov. 2-4, 2022) & Planetary Science Advisory Committee meeting (rep.: L. Schaefer)
- Organization of the ExoPAG27 meeting (all EC members)

ExoPAG ongoing & recent activities II (since the last APAC meeting)

- Great Observatory Maturation Program (GoMaP) workshop II, 11-13 Oct. (rep.: [B. Mennesson](#) & [M. Bottom](#))
- Cross-PAG SAG on barriers to participation (rep.: [N. Batalha](#)). Cross-AG IDEA working Group (rep.: [E. May](#)), first meeting focused on the state of the profession.
- ExoExplorers Program (rep.: [K. Colon](#) & [N. Batalha](#))

ExoPAG ongoing & recent activities III (since the last APAC meeting)

- NASA Open Science Initiative (Liaison: **N. Batalha**).

ExoPAG EC meeting 9/21: the EC discussed the Space Telescope User Committee Report (no endorsement of the Zero Exclusive Access Period and recommendation to solicit broader community feedback). The EC supports the STUC's decision/recommendation and discussed community concerns regarding no proprietary data for JWST

- Science Interest Groups (SIGs) and Study Analysis Groups (SAGs):
 - SIG2 "Exoplanets Demographics", finalizing report (Christiansen & **Meyer**)
 - SIG3 "Exoplanets Solar System Synergies", on-going (Meadows & Mandt)
 - SAG23 "The Impact of Exo-Zodiacal Dust on Exoplanet Direct Imaging Surveys" (**Debes**, Rebollido, Hasegawa)

Cross-PAG SIG to support IROUV GOMaP-related activities

Meeting of the PAGs EC Chairs on Sep 9, 2022: agreement on the number/distribution of leads among PAGs. New discussion planned after this APAC meeting to better define the TOR

- The SIG would conduct analyses on scientific and related technical issues that would inform GOMaP
- The SIG would take full advantage of work done previously by STDTs, and other entities such as the NASA Exoplanet System Science (NExSS) research coordination network
- All PAGs will be included in this activity: coordination by a five-person team comprised of members of ExoPAG, COPAG, and PhysPAG
- The SIG would conduct analyses coordinated and prioritized by the leadership team
- Specific analyses would result in technical reports addressed to NASA's Astrophysics Division in time-limited activities
- We expect that such a cross-PAG SIG would be useful to APD for several years

ExoPAG 27 meeting

announcement on exopagannounce@jpl.nasa.gov

- Saturday Jan. 7 & half day Sunday Jan. 8 in Seattle...working on the agenda
- Two major changes (discussed and approved by the EC): 1. More accessible presentations (reduce acronyms, more background); 2. Group presentations by topic (D. Dragomir & O. Cohen)
- Mini-symposium focused on recent JWST results with contributions from early-career scientists (E. May)

ExoExplorers Program Update



<https://exoplanets.nasa.gov/exep/exopag/exoexplorers/exoexplorerswelcome/>

Steering Committee: T. Kataria (chair), N. Batalha, J. Christiansen, K. Colón

- Second cohort of ExoExplorer Science Series (Jan-Jun 2022), 12 early-career scientists
- Scope of the program expanded to include international ExoGuides and ExoExplorers
- ExoExplorer Program Steering and Organizing Committees developed the call for the next round of ExoGuides and for the third cohort of ExoExplorers in Jul-Aug 2022. Applications due Sep 2022
- 48 ExoExplorer applications were submitted along with 4 new ExoGuide nominations
- Reviews are underway to select the next class of ExoExplorers and ExoGuides.
- The first cohort of ExoExplorers have a Special Session at AAS 241 (Jan 2023) *“The ExoExplorers: Early-Career Perspectives on the Intersection of Exoplanet Science and DEIA in Astronomy”*

ExoPAG SAG 23

Co-leads: [J. Debes](#), Y. Hasegawa, I. Rebollido

The Impact of Exo-Zodiacal Dust on Exoplanet Direct Imaging Surveys

SAG23 includes 38 members working on eight major subject areas:

- A Catalog of Dusty Systems around Nearby Stars (lead: Steve Ertel)
- A review of host dust systems (leads: Steve Ertel and William C. Danchi)
- The theory of Exozodi Sources and Dust Evolution (lead: Mark Wyatt)
- Post-Processing and Detection of Extended Sources (leads: Ewan Douglas, Max Millar-Blanchaer)
- Pan-Chromatic Radiative Transfer of Exozodis (lead: Ramya M. Anche)
- Prioritization of Precursor Observational Studies of Debris Disks/Exozodis for future direct imaging missions (leads: Max Millar-Blanchaer, William C. Danchi)
- Prioritization of Precursor Theoretical Studies of Debris Disks/Exozodis for future direct imaging missions (lead: Jess Rigley)
- Update and prioritization of ExEP Gaps relevant to Exozodis (lead: Emily Rickman)
- A Review of the Solar System's Zodiacal Cloud (leads: Neal Turner, Geoff Bryden)

Several groups had their first organization meeting

Other interested members of the community are welcome to join and contribute!

LEAG



The background features a large, semi-circular graphic of the Earth from space, with a white orbital path and a grey satellite. The acronym 'LEAG' is faintly visible in the background. The text is overlaid on this graphic.

Lunar Exploration Analysis Group Updates and Action Requests- *December 2022 Edition*

Dr. Amy L. Fagan, LEAG Chair

Presented to NASA Planetary Advisory Committee

6 December 2022

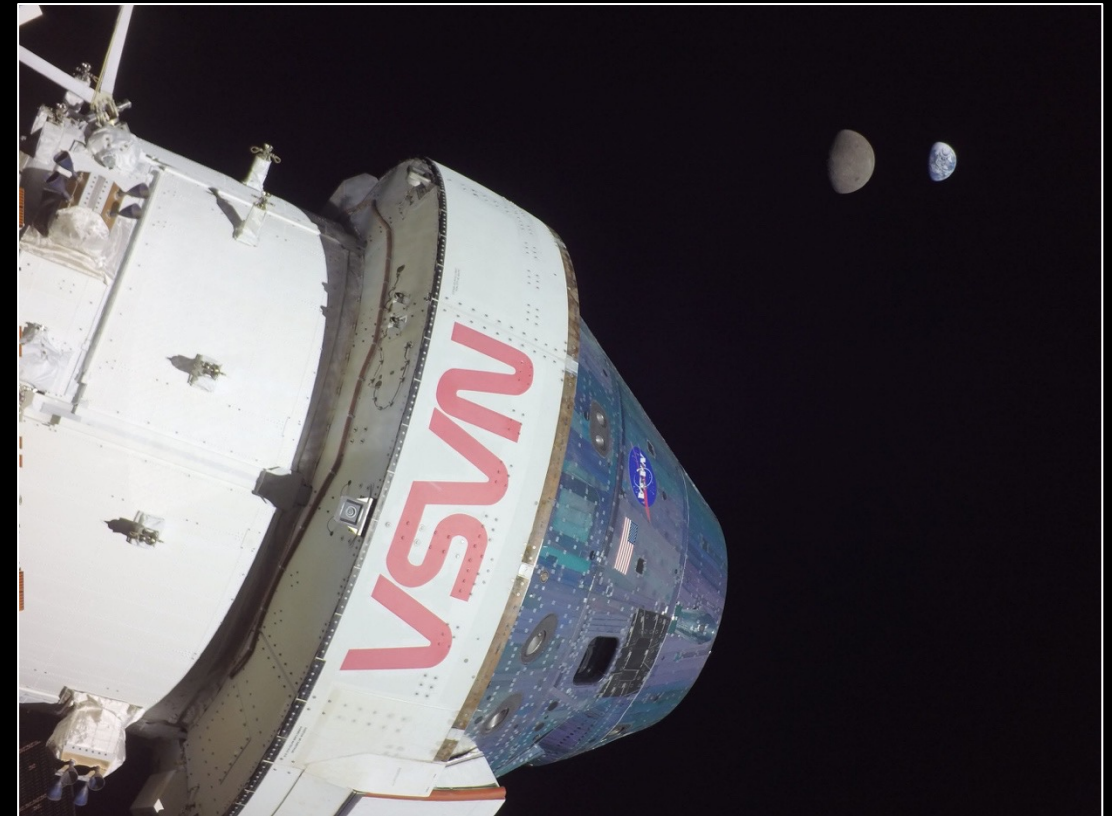
A fervor of excitement permeates the lunar science and exploration community. We are going to the Moon!

- **Recent and upcoming Launches:**

- Artemis 1
- Lunar Flashlight

- **Upcoming Opportunities**

- **Imminent Proposal Deadlines:**
 - SSERVI CAN-4 (December 15, 2022)
 - PRISM-3 (December 20, 2022)
- **Artemis III Geology Team Draft Announcement (Released November 28, 2022)**
 - Town Hall (December 9, 2022)
 - Comments and Questions (December 23, 2022)
- **Artemis Deployed Instruments**



NASA; Artemis 1 flight Day 13; 28 Nov. 2022



Additional LEAG Slides for the PAC

Updates on LEAG Activities since June 2022

Continuous Lunar Orbital Capabilities Specific Action Team (CLOC-SAT)

Responses to Requests for Information

Decadal Survey Support

Continuous Lunar Orbital Capabilities Specific Action Team (CLOC-SAT) has finalized* their report

*In process of beautification

- **Community-recognized need for examination of lunar orbital assets**
 - Lunar Reconnaissance Orbiter is resounding success
 - Strategy development supported by recent LEAG SATs and annual meeting findings
- **Prioritized Community Engagement and Input/Feedback**

CLOC-SAT Team

Ben Greenhagen- Co-Chair, Johns Hopkins APL
Carle Pieters- Co-Chair, Brown Univ.
Tim Glotch- Stony Brook Univ.
Lauren Jozwiak- Johns Hopkins APL
John Keller- NASA GSFC
Paul Lucey- Univ. of Hawaii
Mark Robinson- Arizona State Univ.
Angela Stickle- Johns Hopkins APL
Julie Stopar- Lunar and Planetary Institute
James Tuttle Keane- Jet Prop. Lab., Caltech

Areas of focus: Identify...

- Investigations to be carried out in future
- Capabilities needed for landed science/exploration activities
- Measurements and capabilities common to/cross-cut different mission directorates
- New types of measurements enabled by modern technology

Final Report of the
Continuous Lunar Orbital Capabilities
Specific Action Team (CLOC-SAT)

Lunar Exploration Analysis Group (LEAG)
November 2022

1

Continuous Lunar Orbital Capabilities Specific Action Team (CLOC-SAT) has finalized* their report

*In process of beautification

- **Principal deliverables:**

- *Why?* (Rationale) *What?* (Specific needs/goals) and *How?* (Opportunities/capabilities)

...to carry lunar science and exploration forward in the next decade(s)

- **Overarching Findings (Selected):**

- Imminent Needs:
 - Orbital capabilities in overall lunar strategy
 - Data acquisition and access/relay capabilities
- Science ↔ Exploration
 - Landing site scale vs. global context
 - Long temporal-baseline capabilities
- Implementation
 - Range of orbits and satellite type
 - Collaboration between assets

Continuous lunar orbital capabilities are essential to moving forward during the coming decades of international science and exploration of the Moon and plans must be made to ensure continuity.

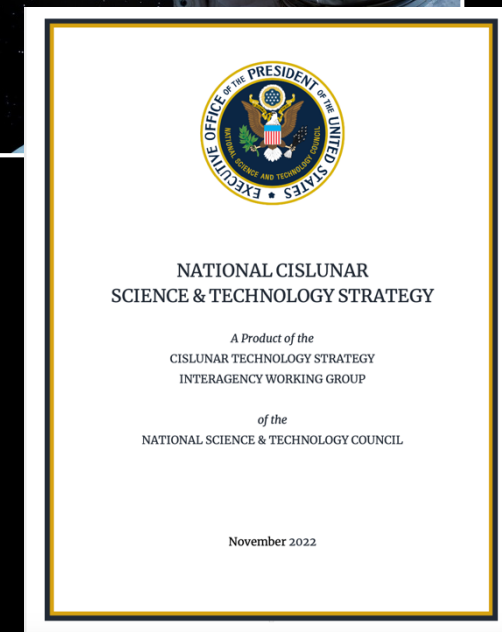
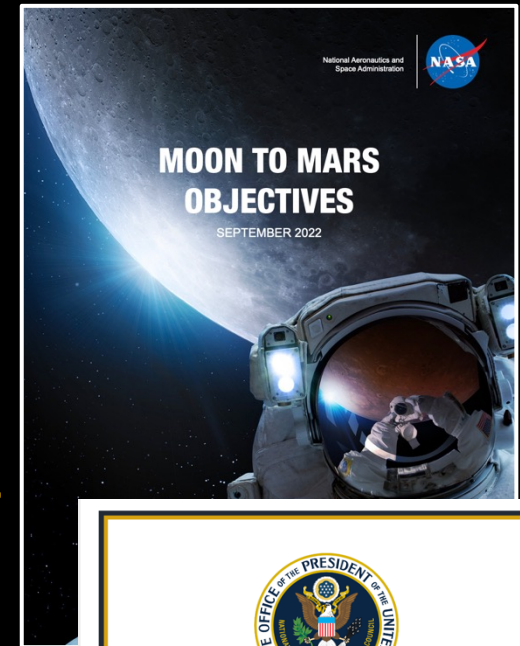
Final Report of the
Continuous Lunar Orbital Capabilities
Specific Action Team (CLOC-SAT)

Lunar Exploration Analysis Group (LEAG)
November 2022

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LEAG was responsive to recent Requests For Information (RFI) related to lunar science and exploration

- **NASA's Moon to Mars Draft Objectives**
 - Executive Committee responded to RFI + representation at Workshop
 - Other community members present (e.g., gov., academia, industry)
 - LEAG and MEPAG have approached ESSIO to help sponsor joint Town Hall for broader community to receive update on finalized objectives
- **White House Office of Science and Technology Policy on behalf of Cislunar Science and Technology Subcommittee of the National Sci. and Tech. Co.**
 1. Research and development priorities for the next 10 years? ... 50 years?
 2. Key technical standards to develop
 - Final report recognizes LEAG's role in the community:
 - "The U.S. government will, in consultation with international collaborators, continue to build and maintain a Cislunar-focused science objectives summary, to include priorities identified in the Decadal Survey and analyses of LEAG as well as broader space science interests. This summary will identify the most compelling scientific studies to be accomplished in Cislunar space. "

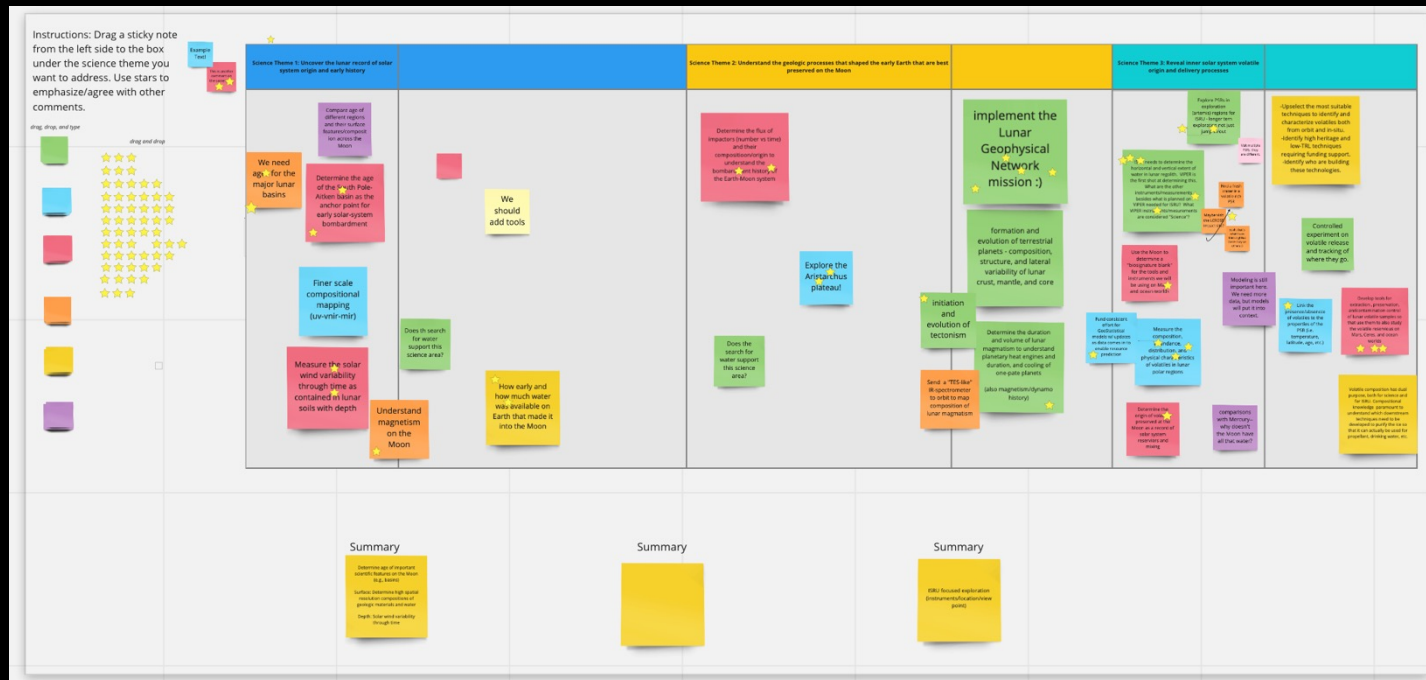


LEAG supports and is responding to the Decadal Survey

- **Findings/Recommendations about Artemis are in broad agreement with LEAG findings**
 - Development of a broad lunar science and exploration strategy → “strategic lunar program”
 - PSD to have authority to develop science requirements for Artemis
- **Decadal Survey highlights need for setting science goals and objectives at the Moon through coordination between NASA and non-NASA community**
 - Ch 22 Finding: “A structured approach to setting science goals and measurement objectives at the Moon, led by the lunar science community ... would allow for scientific prioritization and coordination of lunar missions, instrumentation, landing site selections, and other activities performed within LDEP.” [p22-14]
 - Ch 22 Recommendation: “The advancement of high priority lunar science objectives, as defined by PSD based on inputs from this report and groups representing the scientific community, should be a key requirement of the Artemis human exploration program...” [p22-14]

LEAG supports and is responding to the Decadal Survey

- LEAG began an action response to the Decadal regarding science goals at the annual meeting
 - “in-class” activity guided by Box 22.2



BOX 22.2 Science Themes for Lunar Exploration

The central goal of a science-driven program of lunar discovery and exploration is to reveal the history of major events and processes that have shaped the Earth–Moon system and the solar system. The committee prioritizes three overarching Science Themes that address (1) Solar System History, (2) Geologic Processes, and (3) Water and Volatiles.

Science Theme 1: Uncover the lunar record of solar system origin and early history. The Moon’s composition, structure, and ancient surface preserve a record of early events: from the giant impact that produced the Earth–Moon system to ongoing bombardment as life on Earth emerged and evolved.

The Moon’s composition and physical properties constrain how the Earth–Moon system formed, while its ancient surface preserves the primordial history of asteroid and comet impacts and other processes. This record holds clues to environmental conditions on Earth as life emerged that have been all but erased on the Earth. Analyses of returned lunar samples also provide the basis for a chronology used to understand the sequence and timing of events across the solar system. Key questions remain about the nature of planet formation in the inner solar system, early bombardment, and related hypotheses of giant planet orbital migration. While exploration of other worlds can contribute to addressing these questions, the Moon will remain unique in its ability to provide accessible ground-truth constraints on terrestrial planet assembly and solar system bombardment history and chronology.

Science Theme 2: Understand the geologic processes that shaped the early Earth that are best preserved on the Moon. The Moon retains a record of processes that set the evolutionary paths of rocky worlds, including volcanism, magnetism, tectonism, and impacts.

The Moon is amongst the rocky worlds of the solar system that best preserve ancient geologic processes. Like the terrestrial planets, including Earth and Mars, the Moon started as a partially (or completely) molten world. As the magma ocean cooled, it produced the Moon’s current differentiated structure, including a crust, mantle, and partially molten core. While differentiation is a ubiquitous process, most other worlds have a poorly preserved record of these early epochs—making the Moon one of the best locations to understand these processes. Even as the Moon’s geologic activity waned, volcanism of varied styles and chemistries persisted, impacts and tectonism reshaped the crust, and radiation processes weathered its surface—all of which are relevant to worlds across the solar system.

Science Theme 3: Reveal inner solar system volatile origin and delivery processes. The Moon hosts water and other volatiles in its interior, across its surface, and in ice deposits at its poles, providing a record that may help constrain the origins of Earth’s oceans and the building blocks for life, as well as ongoing volatile delivery processes.

The Moon holds a record of volatiles obtained throughout its history. Primordial volatiles contained in the Moon’s interior suggest that water was retained even through the energetic Moon-forming impact. At the surface, volatiles migrate in an active cycle and are trapped in permanently shadowed regions near the poles, processes that occur at bodies with tenuous atmospheres across the solar system. The origin, composition, concentration, and distribution of the Moon’s volatiles remain uncertain. Determining the source(s) of the Moon’s water and other volatiles may shed light on the source(s) of Earth’s water and on mechanisms that act as ongoing sources of volatiles in the present day. Lunar volatile reservoirs also have implications for in situ resource utilization by human explorers.



Additional LEAG Slides for the PAC

Results/Summary from Annual Meeting (August 2022)

Notes of Gratitude towards NASA

Cross-cutting topics of discussion (interest and concern)

Actionable findings



2022 LEAG Annual Meeting: Appreciation and Gratitude for actively listening, engaging, and adapting/responding to community feedback

- Lunar Trailblazer
- PRISM 3 to propose landing site
- PRISM 3 Survive the lunar night option
- Expected use of the CLOC-SAT report
- Travel grants for early career to attend annual meeting
- RFI for Moon to Mars Objectives

Note: Topics expanded in following 3 slides



2022 LEAG Annual Meeting: Appreciation and Gratitude for actively listening, engaging, and adapting/responding to community feedback

- **Lunar Trailblazer**

- A portion of the LEAG 2021 Annual Meeting Finding #2.3 supported “examining pathways to fly Trailblazer earlier than its scheduled launch date.” We acknowledge and appreciate NASA working through hurdles to move Lunar Trailblazer onto a rideshare with CLPS.

- **PRISM 3 to propose landing site**

- Since Fall 2021, LEAG members have encouraged NASA to consider allowing PRISM proposers to include the ideal landing site for their proposed science rather than prescribing the landing site and soliciting science instrument proposals for a single site. We applaud NASA for listening and examining how this change could work for both proposers and commercial partners and for subsequently allowing PRISM 3 proposers to propose landing sites with their instrument suites.

- **PRISM 3 Survive the lunar night option**

- LEAG 2021 Annual Meeting Finding #2.4 encouraged the development of “*a roadmap of future task orders and pathways*” for CLPS providers, “particularly when they involve a new capability such as mobility, surviving the lunar night, sample return, or pre-deployment of surface assets for Artemis III.” Surviving the lunar night has been a capability of interest for LEAG for several years, and a NASA-hosted workshop on this topic was held in conjunction with the 2018 LEAG Annual Meeting. We thank NASA for adding “survive the lunar night” as an option to PRISM 3 proposers and a goal for commercial partners.



2022 LEAG Annual Meeting: Appreciation and Gratitude for actively listening, engaging, and adapting/responding to community feedback

- **Expected use of the CLOC-SAT report**

- The LEAG Continuous Lunar Orbital Capabilities Specific Action Team (CLOC-SAT) has examined why orbital capabilities are needed, what the needed measurements are to address science objectives, and how those measurements can be achieved. The CLOC-SAT solicited community engagement through a white paper call, open call for membership in the SAT, and feedback to their report drafts. We appreciate NASA representatives expressing interest and excitement at its forthcoming release and their interest in using the CLOC-SAT Report as an input into future orbital strategies.

- **Travel grants for early career to attend annual meeting**

- Prior to releasing a call for proposals to support the Analysis Groups (AGs), NASA actively engaged with the AGs to identify the support needs of each group, including supporting the travel of a number of early career participants. This year marks the first use of those travel funds to help increase the number of in-person early career participants. Numerous participants at the 2022 meeting remarked how wonderful it was to have so many early career participants who likely would not have otherwise been able to attend in-person. We thank NASA for providing these travel grants for early career participants, which actively encourage their participation in the AGs.



2022 LEAG Annual Meeting: Appreciation and Gratitude for actively listening, engaging, and adapting/responding to community feedback

- **RFI for Moon to Mars Objectives**

- NASA released a Request For Information (RFI) for the Moon to Mars Objectives to actively solicit comments on the draft objectives. In addition, selected members of the community, including several from the LEAG Executive Committee and commercial partners, were invited to provide additional context and discussion at an in-person workshop. Furthermore, NASA has updated the community on progress at the 2022 LEAG Annual Meeting and did not shy away from displaying some of the critical comments from the community. We appreciate being asked to comment on the objectives and for ESSIO providing evidence that those comments were heard and acted upon.



2022 LEAG Annual Meeting: Cross-Cutting Topics and Ideas from Discussions and Questions

- Candidate Artemis Landing Regions
- Best practices for Diversity, Inclusion, and Accessibility
- Continuous Orbital Capabilities
- Coordination between remote, surface, and sample analysis/measurements/observations
- In situ Resource Utilization (ISRU) and Science in Tandem (not opposition)
- Science Goals
- Programmatic Balance
- Coordination and exchange of lessons learned between LSITP and PRISM

Note: Topics expanded in following 3 slides



2022 LEAG Annual Meeting: Cross-Cutting Topics and Ideas from Discussions and Questions

- **Candidate Artemis Landing Regions**

- The community expressed excitement that candidate landing regions for Artemis III have been selected, that community feedback will be solicited and will be involved in the down-select process. Although there was great enthusiasm for this endeavor, there was some concern about being able to support community involvement without funding lines for time effort, particularly for community members who are “soft-money.”

- **Best practices for Diversity, Inclusion, and Accessibility**

- When we go to the Moon, we go together as members of various communities in the United States as well as our international colleagues. By following best practices for diversity, inclusion, and accessibility, we strengthen our community and the returns on investment. There are three* new documents outlining best practices and paths forward as well as workshops and documents being planned to help the community to develop Inclusion Plans. We look forward to seeing how Planetary Science will continue to make progress in these efforts, and we appreciate NASA’s effort to engage and support the community. National Academies of Sciences, Engineering, and Medicine. (2022) *Origins, Worlds, Life: A Decadal Strategy for Planetary Science and Astrobiology 2023-2032*. Washington, DC: The National Academies Press.

[*See Findings Document on LEAG website for references](#)



2022 LEAG Annual Meeting: Cross-Cutting Topics and Ideas from Discussions and Questions

- **Continuous Orbital Capabilities**

- Previous LEAG findings and participation from the community in the Continuous Lunar Orbital Capabilities Specific Action Team (CLOC-SAT) demonstrate strong community support for continuous orbital capabilities around the Moon. The community encourages NASA to include orbital assets in the Lunar Discovery and Exploration Program (LDEP) strategy.

- **Coordination between remote, surface, and sample analysis/measurements/observations**

- Both science and exploration benefit from a close coordination between remote observations/measurements (e.g., from lunar orbit or Earth), lunar surface observations/measurements, and sample analysis (in situ and in Earth labs). This was reflected in presentations regarding candidate Artemis III landing site regions, PRISM and CLPS updates, ANGSA updates, and CLOC-SAT summary.

- **In situ Resource Utilization (ISRU) and Science in Tandem (not opposition)**

- The in situ resource utilization (ISRU) and science communities should move forward in tandem (not opposition). Best practices for resource utilization have already been established on Earth to ensure responsible use. Guidance from Earth-based practices can enable further coordination between ISRU and Science on the Moon and other destinations in the solar system, in particular coordination between nation states.



2022 LEAG Annual Meeting: Cross-Cutting Topics and Ideas from Discussions and Questions

- **Science Goals**

- The LEAG community will continue to work to respond to the latest Decadal Survey to facilitate a “structured approach to setting science goals and measurement objectives at the Moon, led by the lunar science community.” The first step for identifying the lunar science goals was undertaken through a small- group activity based on Box 22.2 from *Origins, Worlds, and Life*.

- **Programmatic Balance**

- The Moon was featured prominently as an object of scientific merit in the *Origins, Worlds, and Life* Decadal Survey, but some members of the community are wary of how proposed lunar missions (e.g., New Frontiers) will fare due to programmatic balance. If these missions are not selected, there is unease of how to adequately address and implement Decadal-level science objective investigations.

- **Coordination and exchange of lessons learned between LSITP and PRISM**

- There are many lessons learned between Lunar Surface Instrument and Technology Payloads (LSITP) and PRISM programs, and yet many community members are not privy to them. There was support for encouragement of coordination and exchange of lessons learned between LSITP and PRISM participants with the broader community to better support lunar infrastructure.



2022 LEAG Annual Meeting: Actionable Findings

1. LEAG strongly urges NASA to engage the lunar community actively and continually in the development of the *Integrated Lunar Strategy* through a variety of means.
2. LEAG renews its emphasis on the scientific importance of the collection and return to Earth of samples from the South Pole Aiken basin (SPA) to address a long-standing top priority for lunar and planetary science, and we encourage NASA to continue to explore and openly communicate options for implementation.
3. The LEAG Commercial Advisory Board (CAB) encourages continued engagement with the Commercial Lunar Payload Service (CLPS) providers to (1) develop long-term capability plans and (2) open pathways for long-lived presence on the lunar surface.
4. LEAG encourages NASA to clearly convey its plan for sustainable post-Artemis III exploration to the community forthwith and include specifically how it will result in an increase in the flight rate and extended human surface durations (i.e., Artemis Base Camp).
5. LEAG encourages the establishment of a joint Specific Action Team with the Extraterrestrial Materials Analysis Group (ExMAG) to examine the needs for persistent and sustainable lunar sample return through human and robotic exploration.
6. LEAG encourages the establishment of a joint Specific Action Team with the Mapping and Planetary Spatial Infrastructure Team (MAPSIT) to re-examine dataset management and archiving approaches as well as the suitability of existing data infrastructures.

Note: Findings expanded in following 6 slides



2022 LEAG Annual Meeting: Actionable Findings

1. LEAG strongly urges NASA to engage the lunar community actively and continually in the development of the *Integrated Lunar Strategy* through a variety of means.

At the November 2021 meeting of the Planetary Science Advisory Committee (PAC), LEAG presented an action request for “the development of a broad lunar science and exploration strategy with clear hierarchy/authority...” In addition, the development of a “strategic lunar program” was recommended by the *Origins, Worlds, and Life* Decadal Survey to “achieve decadal-level science goals at the Moon.” We applaud PSD for taking action on these requests and for actively working to develop an integrated strategy. LEAG stands ready to facilitate active community involvement in its development and strongly urges the Planetary Science Division to rapidly form a community working group (such as a specific action team) to aid in the development of this *Strategy*; such a group would be akin to the current involvement of the Mars community in the development of a ten-year strategy through the Mars Concurrent Exploration Science Analysis Group (MCE-SAG). In addition to having active participation from various stakeholders in the lunar community (e.g., government, academia, commercial), we encourage NASA to provide periodic updates to the entire community as the *Strategy* is developed, including communicating the scope of the strategy and how the broader community can provide feedback during its continued development and evolution.



2022 LEAG Annual Meeting: Actionable Findings

- 2. LEAG renews its emphasis on the scientific importance of the collection and return to Earth of samples from the South Pole Aiken basin (SPA) to address a long-standing top priority for lunar and planetary science, and we encourage NASA to continue to explore and openly communicate options for implementation.**

Despite the continued recognition of the importance of this sample collection and analysis, a mission to accomplish this has not yet been selected through New Frontiers. The recent *Origins, Worlds, and Life* Decadal Survey identified a new mechanism to accomplishing SPA sample return through the Endurance mission concept, which was the highest rated mission in the Survey. We strongly encourage NASA to actively involve the planetary science community as it considers how best to implement the Endurance concept. In addition, we urge regular updates to the community regarding study results of budget, implementation options, and timeline. We look forward to seeing how the out-of-the-box thinking of the Endurance mission will finally begin to address this priority and we eagerly await news of the mission development.



2022 LEAG Annual Meeting: Actionable Findings

3. The LEAG Commercial Advisory Board (CAB) encourages continued engagement with the Commercial Lunar Payload Service (CLPS) providers to (1) develop long-term capability plans and (2) open pathways for long-lived presence on the lunar surface.

The CAB continues to support several findings from the 2021 annual LEAG meeting (e.g., 2.4, 2.6) that endorsed the development of a CLPS capabilities roadmap to allow for development time of the necessary technologies and to enable the community to address long-standing science objectives. The Exploration Systems Science Integration Office (ESSIO) and the CLPS Program Office should actively work with CLPS providers to develop a technology roadmap that evolves CLPS capabilities to advance science and exploration objectives prioritized by the lunar community. Such capabilities may include sample return, mobility, surviving the lunar night, or long-term surface assets. We note that, although nuclear power on the lunar surface is enabling for lunar surface operations, commercial use of nuclear power is currently hamstrung by a complex regulatory environment. NASA should work with CLPS providers and other partners with appropriate regulatory authorities to develop a pathway for commercial delivery of nuclear-powered payloads to the lunar surface.



2022 LEAG Annual Meeting: Actionable Findings

- 4. LEAG encourages NASA to clearly convey its plan for sustainable post-Artemis III exploration to the community forthwith and include specifically how it will result in an increase in the flight rate and extended human surface durations (i.e., Artemis Base Camp).**

Artemis will not be truly sustainable unless it includes a robust surface infrastructure and development strategy at a single location on the Moon to catalyze and enable commercial and exploration activities. Progress to date on the Artemis III mission is encouraging, but details of the “sustained” phase of the Artemis campaign are nebulous to the broader community. Current plans suggest a roughly annual cadence of missions of short (<30 days) duration on the surface of the Moon with an emphasis on future mobility (i.e., not for Artemis III), but this does not adequately address the goals set forth in the Lunar Exploration Roadmap. Accordingly, LEAG urges NASA to articulate plans to enable the construction of the Artemis Base Camp and establishment of large-scale resource production by 2030, thereby supporting a permanent human presence on the lunar surface and growth of a vigorous cislunar economy.



2022 LEAG Annual Meeting: Actionable Findings

5. LEAG encourages the establishment of a joint Specific Action Team with the Extraterrestrial Materials Analysis Group (ExMAG) to examine the needs for persistent and sustainable lunar sample return through human and robotic exploration.

Sample return is a critical pathway for addressing high-priority lunar and planetary science goals such as those identified in the current and past Decadal Surveys as well as other key community documents (e.g., 2007 NAC report, “Scientific Context for Exploration of the Moon;” US Lunar Exploration Roadmap; etc.). As we move towards a renewed era of lunar surface exploration through a variety of endeavors (e.g., Artemis; Commercial Lunar Payload Services), we expect an upcoming influx of scientifically priceless material returned to Earth, and the sample community (and their laboratory facilities) must be prepared to properly curate and analyze these samples. The 2019 “Strategic Investments in Instrumentation and Facilities for Extraterrestrial Sample Curation and Analysis” report (National Academies Press) expressed concern about the future of sample return missions with a number of older facilities in need of updating and a need for investing in new personnel. A joint LEAG-ExMAG sample-return activity could examine and review a multitude of topics including, but not limited to: (1) current state of sample-return science objectives; (2) highest priority sample-return materials and landing sites of interest to the community; (3) implementation and infrastructure approaches for sample-return (e.g., human and/or robotic); (4) Earth-based curation of materials to ensure maximum pristinity for future generations; (5) Earth-based analysis approaches and technological development needs; and (6) Earth-based analytical facility and personnel needs.



2022 LEAG Annual Meeting: Actionable Findings

6. LEAG encourages the establishment of a joint Specific Action Team with the Mapping and Planetary Spatial Infrastructure Team (MAPSIT) to re-examine dataset management and archiving approaches as well as the suitability of existing data infrastructures.

For over a decade, the vast majority of lunar data collected and publicly archived has been managed by the LRO project and LRO instruments. As numerous new instruments begin to collect data from lunar orbit and surface, the architectures in place need to be reevaluated to ensure resiliencies to support these less-centralized efforts. In addition to traditional, PI-led investigation teams, commercial providers are also collecting valuable datasets that should be archived and available for use by the community. Furthermore, with renewed human exploration of the Moon's surface, new datasets collected at rates and with volumes orders of magnitudes larger than robotic exploration may be realized. It is essential that agreements be reached between all stakeholders to ensure public access to these data and the tools required to analyze them. A joint activity between LEAG and MAPSIT could be established to identify: (1) the expected spikes and shoulders in returned data volumes over the next decade and infrastructure for the return of data (e.g., downlink capabilities); (2) hurdles to different stakeholders (e.g., science/investigation teams, commercial providers, human exploration) to archiving data and tools; (3) potential standards for data formats and metadata for a wide range of data types; and (4) new tools and software that may be required to support different types of future data sets.

MAPSIT



Mapping and Planetary Spatial Infrastructure Team (MAPSIT)

Report to Planetary Advisory Committee (PAC)
Dec 5–6, 2022 Meeting



Updates to MAPSIT Steering Committee

Brad Thomson (Univ. Tenn.), *Chair*

Julie Stopar (LPI), *Vice Chair*

Brent Archinal (USGS)

Ross Beyer (SETI/NASA Ames)

Sander Gossens (NASA Goddard)

Justin Hagerty (USGS), *Ex Officio*

Trent Hare (USGS)

Jay Laura (USGS)

Sam Lawrence (JSC), ESDMD rep, *Ex Officio*

Myriam Lemelin (Université de Sherbrooke, Canada)

Jeannette Luna (Tennessee Tech Univ.)

Becky McCauley Rench (NASA HQ), *Ex Officio*

Moses Milazzo (Other Orb), *Ex Officio*

Pete Mouginis-Mark (Univ. Hawaii)

Andrea Naß (DLR, Germany)

Jani Radebaugh (Brigham Young Univ.), *past Chair*

David Williams (Arizona State Univ.)



MAPSIT Findings (1 of 4)

Finding: There is a lack of community tools currently available for **landed image processing**. Many mission teams have to effectively start from scratch, which is particularly challenging for smaller mission teams.

- MAPSIT encourages the development of software to facilitate landed surface operations.
- As a proof-of-concept, the USGS (ISIS) just added support for MSL MastCam for working with grounded sensors via the Community Sensor Model.



MAPSIT Findings (2 of 4)

Finding: Missions with a dedicated “**lead cartographer**” role are more successful than missions without (when target relevant)

- MAPSIT encourages NASA to include language recommending or requiring this role in future calls (where appropriate)
- Examples of mission teams with a designated lead cartographer are VIPER (Volatiles Investigating Polar Exploration Rover) and Europa Clipper
- Some other missions have done this in less formal ways, e.g., Dr. Fred Calef (JPL) is the “keeper of the map” for Mars Science Laboratory



MAPSIT Findings (3 of 4)

MAPSIT has made the **Geologic Mapping Subcommittee (GEMS)** a standing MAPSIT subcommittee under the leadership of Prof. Jeanette Luna (it existed previously in various forms).

- GEMS will focus on issues specific to planetary geologic mapping
- A public call was extended for community membership, and representatives were selected to include planetary surfaces across the Solar System
- Subject matter experts are invited to collaborate across groups
- Group will meet monthly to discuss issues pertinent to geologic mapping
- Initial meetings focused on status of geologic mapping on Venus (in coordination with VEXAG)
 - Desire to **convene future workshop on Venus mapping**
- Future meetings planned to focus on status of lunar geologic mapping (in coordination with LEAG)



MAPSIT Findings (4 of 4)

- As a follow up to the Final Report of the Lunar Critical Data Products Specific Action Team (LCD-SAT; doi: 10.5281/zenodo.7236426), **a Lunar SDI group has been established**
- The Lunar SDI (Spatial Data Infrastructure) group is working diligently on governance documents, and standards with a targeted outreach window in the late winter or early spring. Anyone interested in our work can see it here:
<https://psdi.astrogeology.usgs.gov/moon/governance/intro/>
- The Europa SDI continues to make progress and is linked at the same website.



Upcoming activities

- **6th Planetary Data Workshop (PDW):** June 27-30, 2023 (planned), Flagstaff, AZ, in hybrid format
 - Organizers: Trent Hare (USGS)
- **Planetary Geology Mappers' Meeting:** June 2023 adjacent to PDW, Flagstaff, AZ, also in hybrid format
 - Organizers: Jeanette Luna (TN Tech) and Jim Skinner (USGS)

MEPAG

MEPAG Findings VM16: Introduction

- On October 26-27 MEPAG held a virtual meeting to discuss the outcomes of the Decadal Survey, and to be presented with reports regarding the development of the Mars strategy, the I-MIM Measurement Definition Team, the Mars 2020 mission, MSR, and the Mars Concurrent Exploration-SAG. The findings here represent the consensus of the MEPAG community with respect to the presentations delivered at this meeting.
- With respect to overall themes in these findings, we note that two key elements are infrastructure (Finding 2) and low-cost missions (Findings 2, 4, and 6). MEPAG believes these two concepts should be part of the new strategic plan for Mars exploration.

DRAFT

Findings (1 of 4), VM 15 (26-27 October 2022)

- In the spirit of encouraging a community-endorsed MEP architecture, MEPAG eagerly awaits completion of a draft program strategic plan in the new year, and looks forward to continued community comment and input into the draft plan before it is finalized.
- The urgent need to refresh infrastructure at Mars goes hand in hand with the desire to conduct science at the Red Planet, and science in future years will be profoundly affected without replacing or augmenting the existing infrastructure (including communications relay for current and future landed assets, imaging and weather). MEPAG notes that many key infrastructure elements also support scientific investigations, thus increasing their overall impact and contribution to the program. MEPAG encourages a science-rich plan to refresh Mars' orbital assets, both in the short- and long-term, and suggests that an important part of this solution could be lower cost/size missions.

DRAFT

Findings (2 of 4), VM 15 (26-27 October 2022)

- MEPAG applauds the I-MIM MDT for their hard work in laying out a powerful case for the International Mars Ice Mapper, showing reconnaissance objectives can be met, and that important science goals can be accomplished with both the anchor payload and additional instruments.
- With the Decadal Survey endorsement of the science behind the iMIM and MLE mission concepts, there is a strong rationale for conducting ice science in the coming decade.

DRAFT

Findings (3 of 4), VM 15 (26-27 October 2022)

- The ability to efficiently work with the samples returned by the MSR program, as well as conduct the fundamental science in parallel with sample analysis, requires ongoing support to maintain a healthy, forward-looking, and diverse Mars science community. As recommended by the Decadal Survey, MEPAG encourages MEP to support opportunities for both lines of research in both R&A and future mission calls.
- MEPAG encourages greater collaboration between SMD and ESDMD in order to define scientific goals for human exploration at Mars. This should begin well before the first human missions, so that science can inform decisions before change becomes cost-prohibitive, and so that risk can be bought down early. The responsibility for defining and integrating science requirements for future Moon-to-Mars activities should be held with SMD, as an equal element of future human exploration planning.

DRAFT

Findings (4 of 4), VM 15 (26-27 October 2022)

- MEPAG eagerly awaits the imminent drop of samples in the Three Forks region by the Perseverance rover as the next step in returning samples from Mars back to Earth. The depot contains an impressive array of samples, which a recent workshop determined to be a scientifically return-worthy cache for study on Earth. There are residual concerns, risks related to the progress of the various MSR subsystems heading into the PDR process, and MEPAG look forward to a briefing by the project on progress retiring these risks.
- MEPAG is excited about the science mission possibilities outlined by MCE-SAG. The MCE-SAG concept contains all the elements of a low cost, executable strategically-planned program: science, technology, comprehensive vision (Dynamic Mars), cadence from near to far term, an understanding of the interconnectedness of goals (the “braided river” approach), and preliminary cost and risk assessments. MEPAG supports the architecture outlined in the report as a useful strategy during MSR and encourages NASA to use its elements in the strategic planning currently in progress.

DRAFT

MExAG

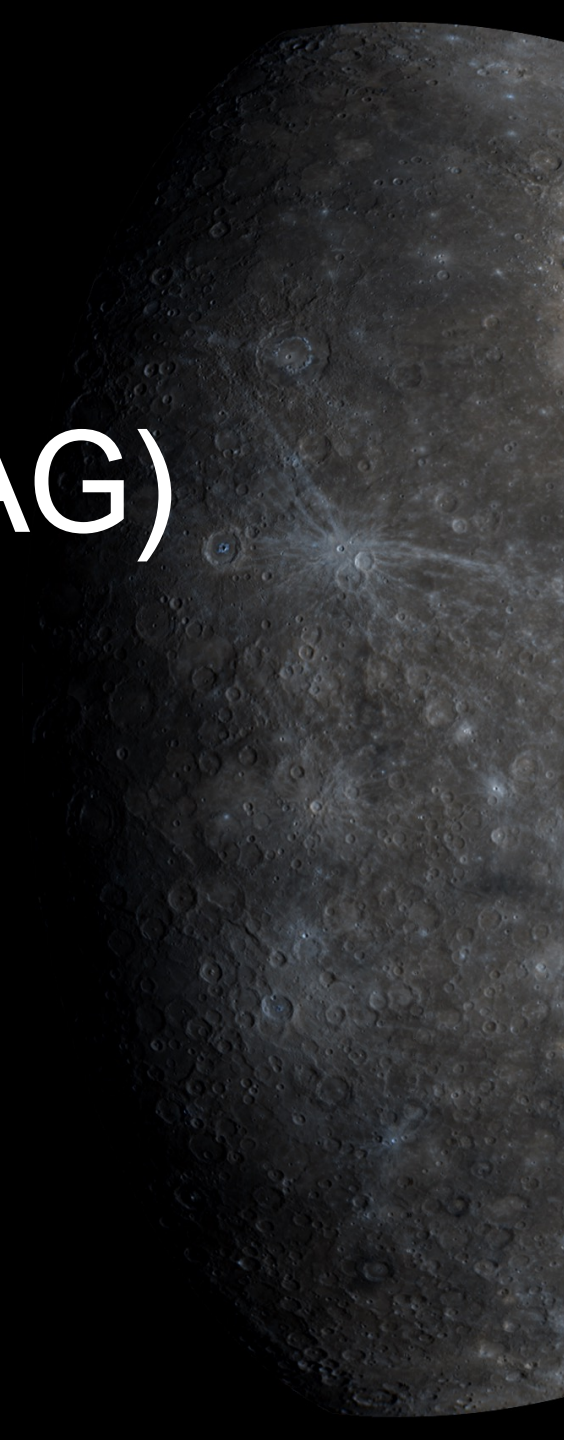


Mercury Exploration Assessment Group (MExAG)

December 06, 2022

Steven A. Hauck, II, MExAG Chair

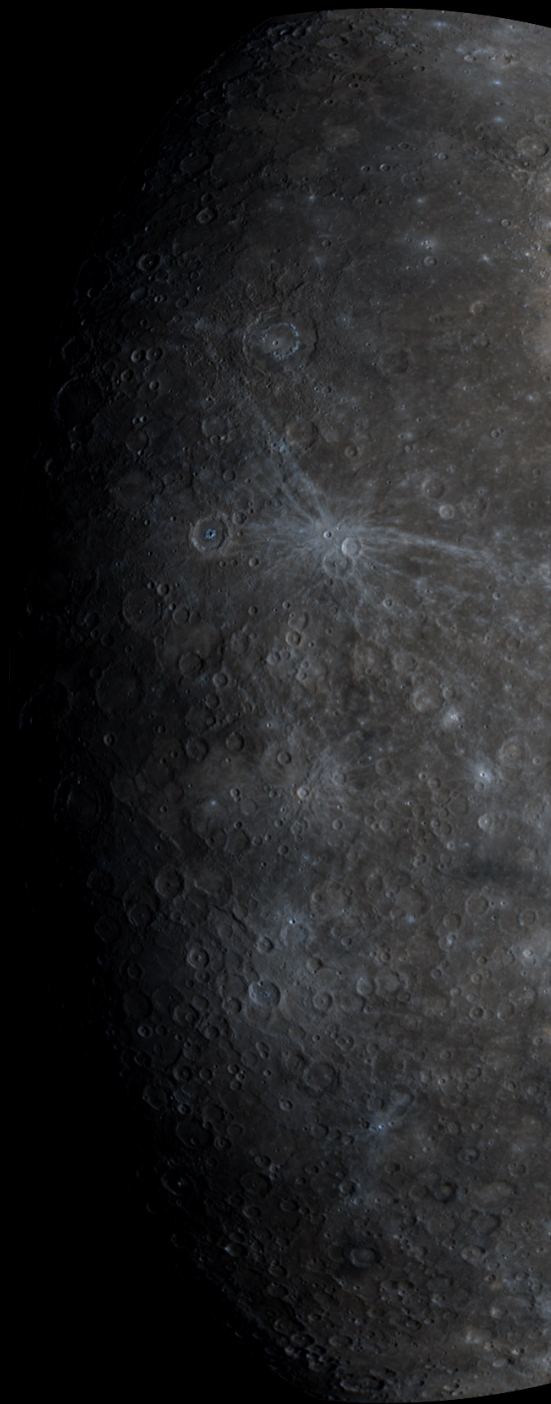
Case Western Reserve University



MExAG Activities and Findings

- **Goals Document:** On target to finalize in Q1 or Q2 2023
- **Technology Showcase:** Facilitated 3 mission concepts
- **MExAG23:** Feb 1–3, 2023 (virtual)
- **Finding:** MExAG encourages NASA to work with ground-based observatories where it acquires observation time to enact policies that equitably enable Mercury observations.
(Full text of finding in backup)
- **Next:** BepiColombo Mercury Third Flyby on June 20, 2023

Backup slides



Ground-based Observatories

- Ground-based optical, infrared, and radio/radar observations play a critical role in the study of Mercury. MExAG encourages NASA to work with key facilities to address procedural/logistical obstacles that create serious challenges for proposals to observe Mercury, particularly during the coming years when support for – and coordinated science with – the BepiColombo mission is vital to provide increased science context.
- MExAG encourages NASA to:
 - Work with optical telescope facilities on which NASA acquires time (e.g., Keck Observatory) and their Telescope Allocation Committees (TACs) to ease the scheduling of twilight-time observations for Mercury. Many telescopes require half-night or even full night proposals; however, Mercury is only available for 1-2 hours at the beginning or end of the night, substantially disadvantaging observers of the innermost planet.
 - Engage with Goldstone and Green Bank Telescope, to ensure that there are equitable opportunities for planetary science observations, particularly now that Arecibo is no longer an option.
 - Allow observers to obtain letters of endorsement from NASA for Mercury observations in support of the BepiColombo mission during the upcoming flybys and orbital mission.

MExAG Steering Committee



Steven A. Hauck, II
Case Western Reserve U.
Chair



Carolyn Ernst
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Catherine L. Johnson
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Gina DiBraccio
NASA GSFC
Magnetosphere Discipline Member



Ariel Deutsch
NASA ARC
Early Career Member



Ryan Dewey
University of Michigan
Early Career Member



Suzanne Imber
U. of Leicester
International Liaison



Shoshana Weider
NASA HQ
NASA Liaison

Recent MExAG and Mercury Activities

- Goals Document Development
- Developing a process for selecting MExAG Chair and Vice-Chair positions
- Support for NASA Technology Showcase

Decadal Survey – Notable Mercury

- Decadal level Mercury science was highlighted throughout *Origins, Worlds, and Life*, indeed in most of the priority question topics.
- Technological challenges, and the to address them, of Mercury's extreme environment were highlighted as well.
- Dozens of mentions of the need for samples and *in situ* measurements of Mercury underscore the importance of landing a spacecraft on the planet.

Decadal Survey – Highlighted Recommendations

- R&A constitute 10% of PSD budget.
- Technology be 6–8 % of PSD budget.
- New NF concepts due to new discoveries be evaluated before NF-7.^a
- Plutonium-238 needs be evaluated against mission portfolio and increased as needed.^a
- Expanding support for ground-based telescope observations and planetary astronomers.^a
- Reviewing current radar infrastructure to meet community needs, including replacing capabilities lost with Arecibo.^a

Upcoming Mercury Meetings and Events

- Mercury Session, AGU Fall Meeting, 12–16 December 2023
- MExAG 2023, 1–3 February 2023
- Mercury 2024, To be held in Japan
- BepiColombo:
 - Mercury Flyby 3, 20 June 2023

MExAG: <https://www.lpi.usra.edu/mexag>

Twitter: [@ExploreMercury](https://twitter.com/ExploreMercury)

MExAG



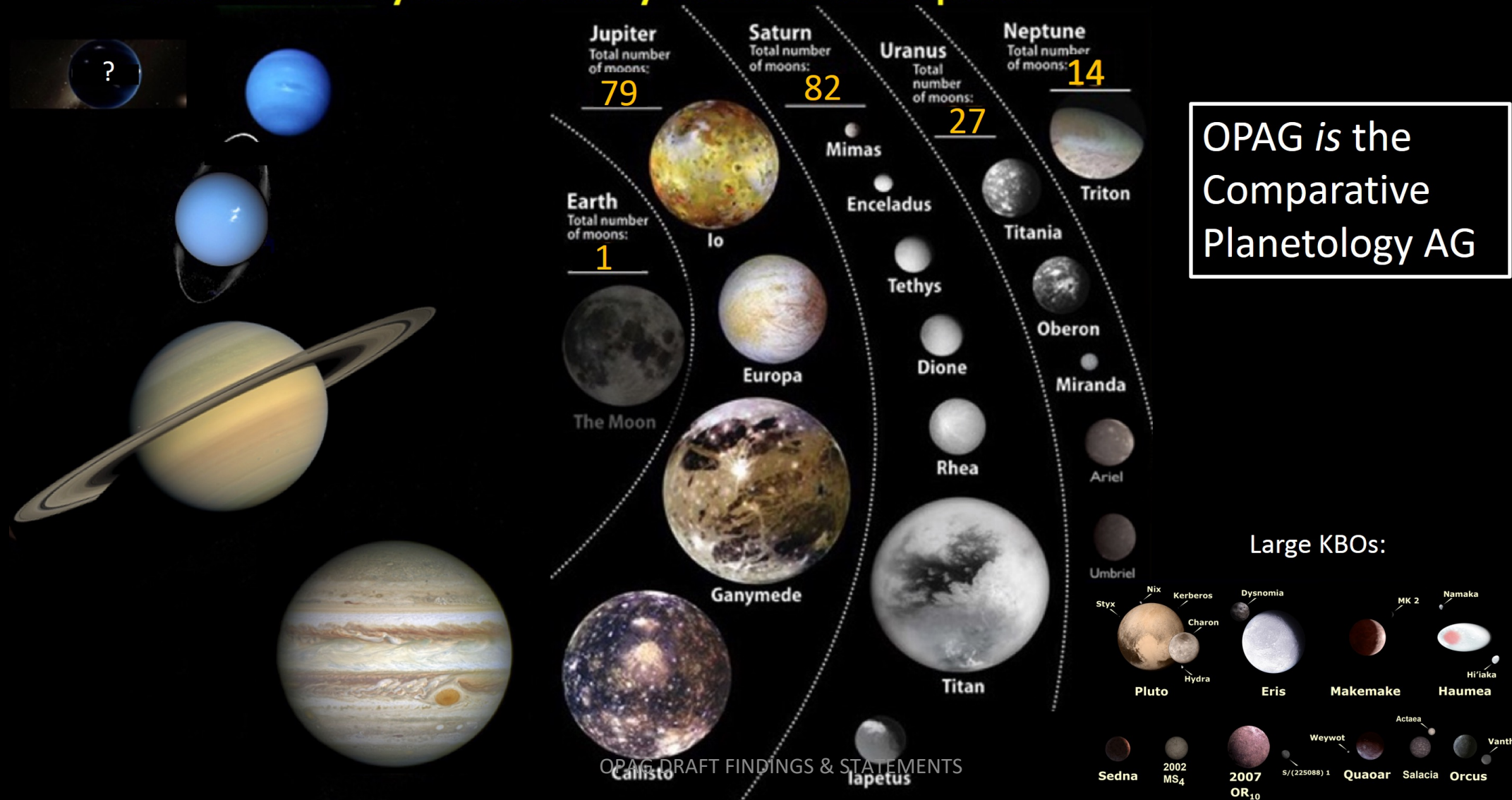
OPAG



OPAG Update to the Planetary Science Advisory Committee (PAC)

Amanda Hendrix, OPAG Chair, PAC Meeting, 5-6 December 2022

Outer Solar System: Many Worlds to Explore



OPAG: draft findings from November 15-16 community meeting

- **OPAG strongly supports the Europa Clipper Mission and commends JPL and NASA for working together to make Clipper the highest priority planetary flagship mission as it moves to launch in October 2024.**
 - We thank Lori Glaze and NASA HQ for prioritizing Europa Clipper to preserve schedule margin as instrument deliveries and integration proceed. We are supportive of NASA's efforts to resolve issues regarding Center workforce as highlighted in the Psyche IRB Report to minimize impact to current and future missions.
- **OPAG urges NASA to fund focused studies for Uranus Orbiter and Probe (UOP), to methodically prepare for and clear a path to Phase A. In particular, OPAG encourages NASA to start work in FY23 on the following topics:**
 - Exploration of trajectories and launch capabilities (to arrive at Uranus well before the equinox in 2049);
 - Models to retire the radiation risk environment for close orbits of Uranus;
 - Identification of potential science instruments and performance parameters, including those pertaining to astrobiology and/or ocean worlds exploration as specified in the UOP study science objectives and OWL recommendations.
- **OPAG is strongly supportive of continuing investment in outer planets related R&A programs. OPAG requests the following:**
 - that the Dual Anonymous Peer Review (DAPR) process be expanded to include the technology programs (MatISSE, PICASSO, etc.)
 - that the Precursor Science Investigations for Europa (PSI-E) program be a recurring call (we suggest every 2 years) to support the Europa Clipper mission and to draw in additional science expertise

OPAG Statement of Concern: R&A

- OPAG is concerned about the recent drop in NASA ROSES proposal submissions and encourages NASA to continue to monitor and evaluate the potential causes behind this decrease. Furthermore, OPAG is interested in whether the No Due Date (NoDD) program is working as intended and whether various aspects (e.g., the turnaround time) can be improved.

OPAG Statements of Support - 1

- **Support of selected missions and ensuring expected cadence for the next Discovery.** *Competed missions are a critical component of the planetary science endeavor, and OPAG strongly supports VERITAS as a selected mission. OPAG furthermore encourages and supports NASA in its best efforts to continue with the cadence of Discovery calls as recommended by the Planetary Science and Astrobiology Decadal Survey, *Origins, Worlds and Life* (hereafter referred to as OWL).*
- **Strategic planning to enable outer planets missions.** Given the challenges with outer planets missions, whose launch opportunities are more prone to negative impacts when schedules and budgets are shifted, OPAG encourages NASA to follow the intent of OWL, and consider updating the New Frontiers lists to include targets (e.g. Triton) that may have time-constrained mission opportunities. Such a consideration would mean that a particular target that is linked to a time-constrained mission opportunity would not be locked in to a particular NF# list, allowing more launch flexibility.

OPAG Statements of Support - 2

- **Unfunded Co-Is on international missions (including JUICE).** The community continues to be concerned about the lack of funding support for US-based Co-Is on international missions, including (but not limited to) JUICE. At the November 2022 meeting, the OPAG community was told that the opportunity will arise for these unfunded Co-Is to apply to become Participating Scientists, which OPAG strongly supports. OPAG encourages NASA to develop a path forward for a JUICE Participating Scientist Program that ensures unfunded US Co-Is are eligible to apply.
- **Deep Space Network issue.** OPAG remains concerned about the aging Deep Space Network, particularly as we enter the JWST and Artemis era. OPAG strongly supports NASA's efforts to maintain and improve deep space communication capabilities
- **NF5.** OPAG may include comments in our final findings report, after the NF5 draft call is released

OPAG Statements of Support -3

- **Facilities.** While funding facility maintenance and development is a concern in general and should be decided on a case by case basis, OPAG encourages a rigorous process of knowledge capture when a facility stands down and to ensure that the capability can be revived after a sizable time gap. A notable example of OPAG interest is the capability to manufacture thermal protection systems (TPS) needed for atmospheric entry missions; specifically, woven TPSs—such as HEEET (Heatshield for Extreme Entry Environment Technology) and 3MDCP (3d mid-density carbon-phenolic)—require specialized weaving and resin infusion facilities that become dormant between productions. OPAG is concerned about having plans in place beyond fulfilling current production needs, to strategically preserve and maintain these facilities and retain the experience to operate them during the dormant periods, including the retention of processing knowledge. (A related counter example from the past is the partial loss of knowledge-base, manufacturing and testing capabilities of carbon-phenolic after the Galileo mission.)
- **Inclusion Plan.** OPAG endorses the Cross-AG WG Inclusion Plan recommendation:

“We believe Inclusion Plans could be a useful way to increase EDIA in planetary science. However, the labor of not only implementing these plans, but also of developing them and gathering relevant resources, needs to be provided by NASA and/or paid to the community. NASA should work with the community to explore ways to develop resources (including funding) to educate the community. This should include education of why inclusion plans are important and ways they could be implemented. Resources also need to even the playing field between PIs who have access to DEIA experts (perhaps through a University office) and those who do not.”

OPAG Statements of Support - 4

- **RPS.** OPAG recognizes and appreciates NASA's ongoing investment and support for the RPS Program. As the outer planets community relies heavily on RPS technologies, OPAG appreciates receiving continued updates to the community about (1) NASA's commitment on the number and types of RPSs (specifically RTGs) to be fabricated and fueled, and how these are assigned to future missions, and (2) for mission planning purposes details on the characteristics of these power systems, including their expected mass, size, electric and thermal power outputs (at beginning and end of life), and number of GPHS modules they use. We request continued updates as the PSD plans evolve on new missions from Flagship through New Frontiers to Discovery class. The community also appreciates the improvements and streamlining to the EA and NEPA approval processes. (For example, as applied to the Dragonfly Environmental Assessment (EA) / Finding of No Significant Impact (FONSI) (vs the Environmental Impact Statement (EIS) / Record of Decision (ROD)) and to the launch approval process. It has been shown that if the EA results in FONSI, missions can simplify the approval process and save up to \$1.7M, and a year of schedule related to NEPA compliance.)

OPAG Statements of Support - 5

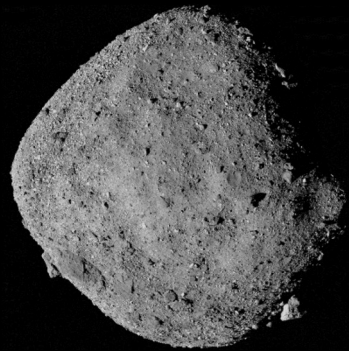
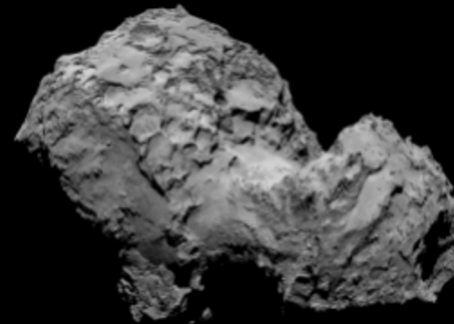
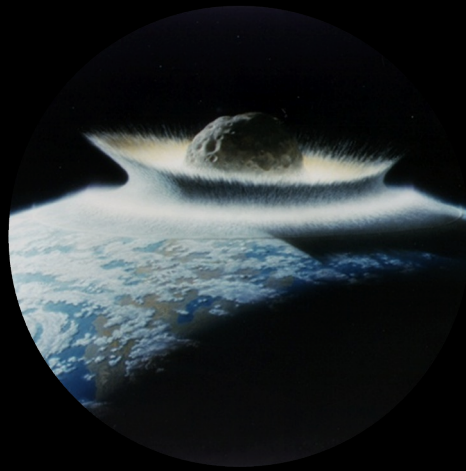
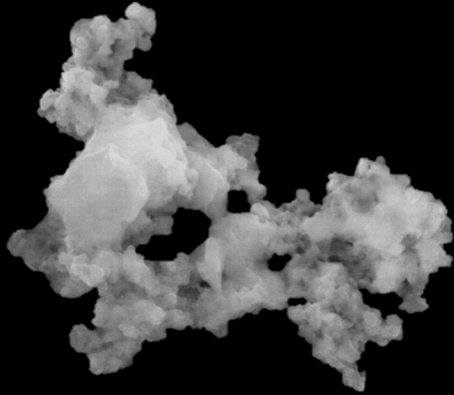
- **Planetary radar.** OPAG concurs with the recent SBAG finding:
“SBAG recommends that NASA continue to work with NSF and other agencies to develop a concerted plan for new national resources for planetary radar. This path follows the Decadal Survey recommendation to “develop a plan for ground-based planetary radar capabilities comparable to or exceeding those of the Arecibo Observatory necessary for achieving planetary defense objectives”. As well as serving the needs of planetary defense and the broader area of small body science, new radar resources will enable further scientific studies of objects throughout the Solar System.”
- **SIMPLEx.** OPAG supports releasing the next round of SIMPLEx AO at the soonest possible time. SIMPLEx-class missions enable new innovative measurements that address high-value science goals for the planetary science community, including OPAG. SIMPLEx missions are also critical entry points for new mission PIs and broaden access to space-based measurements. Discovery and New Frontiers proposals are significantly greater undertakings than most competed missions supported by other SMD divisions, and PSD’s SIMPLEx program fills an important gap to enable new innovations and to allow more planetary scientists to gain mission management experience.

OPAG Statement of Support: Ocean Worlds Working Group

- OPAG is encouraged by NASA's support in forming the joint OPAG/SBAG/NOW Ocean Worlds Working Group (OWWG) as a vehicle to communicate the goals and needs of the Ocean Worlds (OW) community to NASA. The OWWG should reflect the intellectual diversity that bridges planetary science and astrobiology, and cover the rich diversity of targets that provide unique opportunities for mission and technology development. In this way, the OWWG will enable the OW community to directly define R&A needs, organize mission development and strategic planning efforts, and identify supporting technology development priorities.
- There has already been significant development of OW priorities in both the Roadmap to Ocean Worlds and the 100+ community white papers that fed into the recent Planetary Science and Astrobiology Decadal Survey which provide a foundation for the OWWG efforts. This working group will also provide the necessary community infrastructure to hear, share, and document new ideas as the science continues to evolve. The OWWG will communicate their findings through OPAG, SBAG, and NOW to the PAC.

SBAG





Lori Feaga, SBAG Steering Committee Chair
Department of Astronomy, University of Maryland, College Park

December 6, 2022

NASA Planetary Science Advisory Committee (PAC)

www.lpi.usra.edu/sbag/

Government funding acknowledged

Summary of significant SBAG issues for the PAC

- Apophis Specific Action Team (SAT) Report released; posted on SBAG site; announced in DPS Newsletter and PEN; presented later today to the PAC and in January at SBAG 28
- Ocean Worlds inter-AG collaborative working group general purpose/guidance captured during meeting of SBAG, OPAG, and NOW chairs; leadership search in process (with SBAG representation)
- Psyche Independent Review Board (IRB) implications are a big concern; will be a topic of discussion at SBAG 28 (January 2023); too soon and without community feedback for SBAG to officially respond; SBAG participated in AG Chair caucus to discuss initial thoughts and begin to formulate a united front
- Code of Conduct for the Steering Committee approved at last SC meeting (SC member signatures in process; to be posted on SBAG website)
- Upcoming SBAG 28 meeting January 24-25, 2023; agenda being finalized; Early Career recipients selected and notified (2 invited talks, 5 lightning talks)
- High priority findings from SBAG 27 were elevated and presented at the last PAC meeting (June 2022); will undoubtedly continue to be concerns for SBAG community (national resources for planetary radar capabilities and timely fulfillment of the George E. Brown Congressional goal of discovering 90% of the near-Earth asteroid (NEA) population larger than 140 meters in size with NEO Surveyor)

Supporting slides

Apophis Specific Action Team (SAT) Report Update

Statement of Task:

The Specific Action Team (SAT) shall conduct a study to:

1. Identify and quantify the detectable effects on Apophis expected to result from the Earth encounter, and identify the measurements and instrumental sensitivities needed to detect them and determine their magnitudes;
2. Assess and prioritize the importance to planetary science and planetary defense of detecting and measuring each of these effects, as well as the value of non-detections (upper limits);
3. Categorize these effects according to (a) detectable using Earth-based assets, (b) detectable using a spacecraft arriving only after Earth close approach, (c) detectable using a spacecraft arriving before Earth close approach; and
4. Quantitatively assess the possibility that spacecraft sent to Apophis could increase the risk of a future Earth impact.

The study shall not:

Assess, prioritize, or recommend specific instruments, facilities, flight hardware, mission profiles or concepts;

Members: Jesse Dotson (Chair), Tim Titus, Stephanie Jarmak, Andy Rivkin, Marina Brozovic, Steve Chesley, Damya Souami, Paul Sanchez, Nick Moskovitz

Report released: November 11, 2022 (https://www.lpi.usra.edu/sbag/documents/Apophis_SAT.pdf)

Report to be presented to PAC and SBAG: PAC on December 6, 2022 (Jesse Dotson); SBAG on January 24, 2023 (Jesse Dotson)

Informational Slide on Ocean Worlds Inter-AG Working Group

Ocean worlds inter-AG collaboration: The SBAG community is in favor of establishing an inter-AG collaborative working group between OPAG and SBAG on ocean worlds. This plan is in keeping with the Decadal Survey recommendation that “NASA should develop scientific exploration strategies, as it has for Mars, in areas of broad scientific importance, e.g., Venus and ocean worlds, that have an increasing number of U.S. missions and international collaboration opportunities.” SBAG suggests that leadership of such an inter-AG collaboration should be selected by liaison representatives from OPAG and SBAG from an applicant pool resulting from an open call to the community at large and general membership/participation in the working group include all interested parties from the ocean worlds community (e.g., SBAG members, OPAG members, astrobiologists, oceanographers, etc.). It is envisioned that the inter-AG working group may hold semi-regular coordinated meetings or other activities and report back to the AGs points of concern. These points of concern will be discussed during AG meetings and as warranted will be elevated to the PAC as findings from the meeting.

The Steering Committee

Present Steering Committee

Justin Atchison (JHU/APL), [Technology Lead](#)

Olivier Barnouin (JHU/APL)

Bonnie Buratti (NASA JPL/Caltech), [Past Chair](#)

Michael Busch (SETI Inst)

Lori Feaga (Univ of Maryland), [Chair](#)

Henry Hsieh (Planetary Science Institute)

Mihaly Horanyi (Univ of Colorado, Boulder)

Stephanie Jarmak (SwRI), [Early Career Secretary](#)

Prajakta Mane (LPI/NASA JSC)

Joe Masiero (IPAC/Caltech), [Planetary Defense Lead](#)

Stefanie Milam (NASA GSFC)

William O'Hara (Blue Origin), [Human Exploration Lead](#)

Timothy Titus (USGS, Flagstaff)

Thomas Statler [NASA Headquarters Liaison](#)

Jake Bleacher [NASA Human Exploration and Operations Mission Directorate \(HEOMD\) Liaison](#)

Paul Abell (JSC) [HEOMD Observer](#)

Steering Committee selects Chair and Steering Committee members from among nominations and applications. Requests go out on the DPS Newsletter, Planetary Exploration Newsletter (PEN), and our listserv. General membership is open to the community.

Other Meeting and Steering Committee Updates

1. Meetings of SBAG are twice a year, in January and June.
2. **SBAG #28** will take place January 24-25, 2023 at IPAC (Infrared Processing and Analysis Center) on the CalTech campus in Pasadena, CA. It is a 2-day hybrid meeting. The agenda is being finalized and will be posted to the SBAG meetings website soon.
(<https://www.lpi.usra.edu/sbag/meetings/sbag-28/>)
3. The **SBAG Early Career Secretary** term will end in January 2024 and by design the outgoing and incoming secretary overlap for 6 months for a smooth transfer of duties, thus, SBAG will be searching to fill the EC Secretary position during its June 2023 meeting, with announcements through various channels in the spring for applicants. The Human Exploration Lead and 3 at large members rotate off too and replacements will be solicited.
4. Members present at the November 2022 SBAG SC telecon unanimously approved the **SBAG Code of Conduct**. SC members will provide electronic signatures at the bottom of the document to acknowledge receipt and adherence to the code. All members had a period of comment prior to the vote.

Summary

- 1. SBAG appreciates the support from the PAC and NASA on the various findings and initiatives we bring forth as a voice of the small bodies community.**
- 2. SBAG is behind the Decadal Report 100% and will continue echoing the needs of the community in accordance with OWL.**
- 3. SBAG supports the efforts of a cross-AG Ocean Worlds Working Group.**
- 4. SBAG promotes a safe and more equitable work environment for all members of the community and has fully adopted a Code of Conduct for the Steering Committee and has representation in the inter-AG IDEA working group.**
- 5. SBAG strongly supports early career scientists by actively including them on the Steering Committee, inviting them to fully participate in SBAG meetings, providing mentor pairings at meetings, and awarding travel stipends to offset meeting costs.**

VEXAG



Supplementary VEXAG
Slides for PAC Meeting

Dec 6, 2022

20th Meeting of the Venus
Exploration Analysis Group

Nov 7-9, 2022

Albuquerque NM

VEXAG

300+ registered, 70+ In person
attendees, 90+ Online at once.

FINDINGS (Advanced Draft)

- **VERITAS needs to be launched as soon as possible, without any further delay.** VEXAG suggests that VERITAS be prioritized over solicitation of new proposals, particularly for the same mission class.
- A “**Precursor Science Investigations – Discovery**” (**PSI-D**) **R&A program**, focused on ensuring success of and maximum scientific return from upcoming Discovery missions and the EnVision partnership, is in the interests of the broad planetary community.
- A new “**CloudTech**” **R&A program** to focus on aerial/airborne technologies and implementations applicable to multiple planetary targets, in addition to a **HOTech 3 program**, in an upcoming ROSES cycle would allow focus on maturing important technologies and integration into platforms and systems.

More details, including Endorsements and Questions, in
supplementary slide deck.



VERITAS Impacts from the Psyche IRB report

- *Status:* VERITAS has been directed to stand down. No funds have been allocated for the engineering team in FY24. **NASA will consider re-instating VERITAS in FY25.** The launch date is to be 'no earlier than FY31'. Only VERITAS is impacted. VERITAS is on schedule, on budget, and has an appropriately experienced team.
- *Workforce:* Most of VERITAS' workforce is not at JPL. Currently there are the equivalent of ~35 fulltime JPLers, many of whom are radar engineers. Delaying VERITAS by ~3 years shifts the JPL workforce pile-up to other partners, who are also supporting DAVINCI (launch in '29) and EnVISION (launch in '31).
- *Cost and Technical Risk:* No impacts were assessed prior to this decision. VERITAS has ~\$80M in contributions from the Italian, German and French Space Agencies. In several cases, contracts have already gone out. Continuing their work without JPL and Lockheed (spacecraft provider) could incur significant risk. Costs will increase due to both inflation and the availability of key components, which could lead to major redesigns. Technical risk is being assessed, but will not be fully realized until a new launch date and funding plan are approved, which will occur at a TBD date. Many team members have worked on VERITAS for over a decade. This stand-down will result in loss of key expertise, creating the potential for an experience gap, which is a key issue called out by the Psyche IRB. Science impacts of this decision were not evaluated.
- *Decadal:* SMD budget issues extend beyond Psyche, as noted by Lori Glaze at VEXAG. The Decadal (p. 653) provides clear guidance on budget priorities. Delaying/standing down of competitively selected missions is not one of the recommended approaches to trimming the budget.



FINDINGS
ENDORSEMENTS
QUESTIONS

VEXAG

VEXAG has retooled “Findings” into 3 distinct categories, seeking the most effective way to advocate for the Venus community, show support, and get the information we need

Findings

- Go to the PAC
- 2 (\pm 1) ONLY
- Inter-AG recommendations for action
- Examples: IDEA policies, Cloud-Tech

Endorsements

- Go to NASA
- Support, thanks, and information from the community
- Examples: HEEET/Adept, LLISSE, RT power

Questions

- Go to SMD director, NASA Liaison, others at HQ, for answers to VEXAG
- Information the community seeks
- Example: Status/Prospects of R&A



DRAFT

ENDORSEMENTS

VEXAG

To be edited, finalized, and delivered in early 2023

Endorsements

OWL DECADAL SURVEY: VEXAG broadly endorses the 2023-2032 Decadal Survey as representative of the planetary and Venus community' priorities and goals. Specific VEXAG endorsements include:

The Decadal recommendation to increase the R and A budget to 10% of the PSD budget.

The Decadal recommended set of guidelines for actions for NASA to take NASA in times of financial shortfalls

The decadal survey recommendation that NASA PSD create a new strategic plan for technology, with a clear mechanism for the AGs et.c to provide their priorities.

NEW FRONTIERS 5: VEXAG endorses the restoration of VISE to the New Frontiers 5 Theme list.

PLANETARY MAPPING: VEXAG endorses the USGS planetary mapping program's statement that Venus quad mapping continues to be important and does not need to wait for upcoming missions - this mapping supplies basic data and useful research that can be used to plan or interpret future missions.

EARTH-BASED VENUS SCIENCE: VEXAG endorses ground-based/balloon/suborbital observations of Venus, including ground-based radar facilities, and leveraging cross-division opportunities that can support Venus and non-Venus communities alike.

LLISSE TECHNOLOGY: VEXAG endorses the completion of development for LLISSE as captured by prior VEXAG findings. Consider potential for contributing as tech demo to NASA, commercial, or international partner to help mature to full capability.

IN-SITU TECHNOLOGY: VEXAG endorses a push for technology of in-situ exploration as critical follow-ons to the DAVINCI, VERITAS, and EnVision missions.

HUMAN SPACEFLIGHT: VEXAG recognizes the science, programmatic, and cross-divisional value of human missions to Venus as described in the recent Keck Institute report.

STUDENT AND CAREER SUPPORT: VEXAG Endorses and encourages NASA efforts to grow and involve diverse early stage scientists and engineers in Venus investigations through R&A programs and mission involvement.

LABORATORY/FUNDAMENTAL SCIENCE: VEXAG endorses lab-based studies and funding opportunities to build and maintain them.



DRAFT
QUESTIONS

VEXAG

To be edited, finalized, and delivered in early 2023

Questions

[PDART PO] Can PDART augment its mapping priorities to explicitly include planetary quadrangle mapping, with whatever caveats necessary to enable completion of the Magellan Quad maps under its auspices? If yes, what can the community do to encourage/ensure this change?

[SSW PO] Can SSW include “generalist” or “fundamental research” options in the call’s checkboxes for proposals that do not have a specific planetary target(s)? If yes, what can the community do to encourage/ensure this addition?

[HQ-VeSCoor] International Partners – The Australian Space Agency is hot for Venus. How can NASA fold in our colleagues down under? This question is generalizable to other smaller international Agencies.

[PESTO] We ask for better clarification of the line between (and the areas of overlap) technologies funded through SMD and those funded through STMD that benefit SMD missions/programs. Other divisions also have overlapping technology development, and we ask for better clarification there as well.

[HQ]: What is the best schedule and method for iterating and finalizing the Venus Exploration Strategy with NASA? We target the 2023 VEXAG meeting as the target date for having the Strategy in place (Oct/Nov 2023)

[HQ] Can Early Career & Student participation in general R&A (and in mission proposals) be generally/globally “strongly recommended” in the AOs, and possibly mandated in some calls.

[SMD & Astrophysics Division] Given the unique opportunities for planetary science presented by suborbital investigations, can SIMPLEX (or smaller) opportunities explicitly enable them, or APRA/Pioneers be opened to them? If so, how do we make it happen, if not, how do we open these capabilities to planetary science?



YEAR IN VEXAG

SUMMARY FROM NOVEMBER 7-9 ANNUAL MEETING

VEXAG STEERING COMMITTEE

NOAM IZENBERG (APL, LAUREL, MD), CHAIR

STEERING COMMITTEE



5 New SC members selected
Dec 5, 2022
3 to begin in 1/23,
2 to begin in 7/23

Noam Izenberg	Applied Physics Laboratory, Chair
Debra Buczkowski	Applied Physics Laboratory, Dpty Chair
Jeff Balcerski	Ohio Aerospace Institute *
Paul Byrne	Washington University *
Natasha Johnson	NASA GSFC *
Stephen Kane	University of California at Riverside *
Molly McCanta	University of Tennessee
Jason Rabinovich	Stevens Institute of Technology
Jennifer Whitten	Tulane, ECR *
Siddharth Krishnamoorthy	Jet Propulsion Laboratory, ECR
Sara Port	Glenn Research Center, ECR
Chuanfei Dong	Princeton University, ECR
Erika Kohler	Goddard Space Flight Center, ECR
Eric Grosfils	Pomona College
Natalie Punt	Scribe
Darby Dyar	PSI, Mount Holyoke College, Emeritus
Megan Ansdell	NASA HQ, ex officio

*Term ends in January 2023



THEMES OF THE 2022
MEETING

VEXAG as a strategy, policy,
community group

Venus Exploration Strategy

Walking the walk of growing a
diverse, equitable community



THREE YEAR GOALS
2023-2025

VEXAG

**Develop Venus Exploration Strategy
for the next decade with NASA**

Work with missions and the international
Venus community

**Nurture the next generation of Venus
scientists and engineers**

Improve communication within Venus
community and among the general
public

Open meetings and public forums



SCIENCE & ANALYSIS
WORKGROUPS (SAWS)
INTO 2023

VEXAG

Retired SAWS condensed into
"Officer" member of the SC

e.g.,

Outreach Officer
Technology Officer
IDEA Officer
EC Officer/ OVEN POC

Contact VEXAG for Officers and SAW POCS

SAW 1: Organization Documentation

SAW 2: VEXAG 2023 Meeting Org.

SAW 3: "Off Season" Meeting Org.

SAW 4: Venus Exploration Strategy

SAW 5: Venus Science Nuggets

SAW 7: Venus Experimental Facilities

SAW 8: Outreach

SAW 9: Venus Social Media

SAW 10: VEXAG website

SAW 11: IDEA: Inclusion Diversity Equity Access

SAW 12: Aerial platforms

SAW 13: Early Career Outreach

SAW 14: Venus Mapping

SAW 15: Surface Platforms

SAW 16: Mentoring

THEME CHANGE / RETIRED / NEW



SUMMARY

VEXAG

VEXAG Website: lpi.usra.edu/vexag
Update coming in December

VEXAG Final FEQ: ~January

VEXAG POCs

Chair: Noam Izenberg noam.izenberg@jhuapl.edu

Deputy Chair: Debra Buczkowski

debra.buczkowski@jhuapl.edu

VEXAG Steering Committee VEXAGSC@gmail.com

VEXAG Social Media: Twitter @unveilvenus

Next VEXAG events:

Town Hall at LPSC March 2023

21st meeting in October/November 2023