
MExAG

Mercury Exploration Assessment Group (MExAG)

February 15, 2022

Steven A. Hauck, II, MExAG Chair

Case Western Reserve University

MExAG Steering Committee

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

Carolyn Ernst
JHU APL
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UBC & PSI
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Magnetosphere Discipline Member

Ariel Deutsch
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Early Career Member

Gang Kai Poh
Catholic U./ NASA GSFC
Early Career Member

Suzanne Imber
U. of Leicester
International Liaison

Shoshana Weider
NASA HQ
NASA Liaison

MExAG Annual Meeting Summary

- February 1–3, 2021 [virtual] (3 hrs/day)
- >250 registrants, ~55% US/45% international
- 85–120 participants per day
- 53 presentations
- 3 additional sessions (2 early career, 1 networking)
- Working Sessions to refine the Goals Document

IDEA-WG

- MExAG is committed to Inclusivity, Diversity, Equity, and Accessibility (IDEA) principles and supports the efforts of the IDEA working group. MExAG recommends that NASA defines, formalizes, and supports both its relationship with the IDEA working group and, in consultation with the other AGs, the IDEA WG's relationship to the AG ecosystem.

New Frontiers

- MExAG is concerned that the delay in the New Frontiers 5 (NF-5) call, especially without the scope to update the NF-5 destination list in the upcoming Decadal Survey, substantially hinders NASA's ability to respond to outcomes of its own missions (both NASA-led missions and missions led by partner agencies) and other mission-enabling activities. By maintaining the NF destination list defined in *Vision and Voyages* (2011), MExAG highlights that NASA is relying on guidance written **more than 10 years** before the upcoming NF-5 call. For Mercury science, specifically, this means that the guidance was provided before the MESSENGER orbital mission and the subsequent revolution in the study and understanding of the innermost planet. This situation, however, is not unique to the study and exploration of Mercury. In addition, MExAG recognizes that the NF-4 call created a precedent for including themes responsive to new discoveries. This approach, therefore, could be used again to mitigate the challenges posed by the NF and Decadal cadences.
- MExAG encourages NASA to develop a defined and transparent mechanism for re-evaluating, and considering additional, NF destinations, especially when more than five years have elapsed since the recommended destinations were originally published.

BepiColombo IDS/GI Programs

- MExAG thanks NASA for working with ESA to include and support U.S.-based scientists on the BepiColombo team as an Interdisciplinary Scientist (IDS)/Guest Investigators (GIs).
- MExAG encourages NASA to work with its international partners to secure the opportunity for U.S. participation in any future BepiColombo IDS/GI calls run by ESA and/or JAXA. In particular, MExAG would welcome an increase in the number of NASA-supported scientists who can participate, especially given the high-level of Mercury-science interest and expertise in the U.S. Such participation would also continue to leverage NASA's significant investments in building Mercury expertise through the MESSENGER mission and analysis of the data it collected.
- In addition, MExAG notes that the previous call for BepiColombo Interdisciplinary Scientists and Guest Investigators stated "The aim of this AO is to appoint up to six IDSs and up to eleven GIs for the BepiColombo mission" without noting how many of those were potentially available to U.S. scientists. MExAG encourages NASA to provide explicit guidance for any future BepiColombo IDS/GI calls regarding the likely number of investigators that would be supported by NASA for this program, i.e., so that potential proposers are fully aware of the programmatic parameters.

Radioisotope Power Systems

- Radioisotope power systems (RPS) are crucial tools for exploring the solar system, particularly in its most extreme environments, such as the surface of Mercury. An RPS system would be an essential element of a future Mercury lander (e.g., as demonstrated in the PMCS study of the NF-class Mercury Lander for the Decadal Survey process), which would likely operate during the Mercury night or within permanently shadowed regions where solar power is not possible.

- The RPS Program currently only follows the guidance of the Decadal Survey, which explicitly excludes Discovery-class missions and cannot foresee the mid-decade inclusion of RPS-enabling NF destinations, such as the Ocean Worlds theme that NASA added to (and selected from) the NF-4 call. MExAG, therefore, encourages NASA to ensure a sufficient supply of RPS and fuel to adequately meet the needs of exploration in the Flagship, New Frontiers (NF), and Discovery lines throughout the solar system – including Mercury.

Scientific Information Policy (SPD-41)

- MExAG supports increasing the openness and reproducibility of science, the primary ideals behind SPD-41.

- MExAG recognizes that the policy is currently open for public comment, but also emphasizes that as currently written, SPD-41 is vague and ambiguous. Examples include which software “provide users some degree of scientific utility” and must be archived, as well as how software and data produced under a combination of NASA and non-NASA (including non-governmental) support shall be treated. MExAG encourages NASA to make the policy sufficiently precise that it can be implemented.

- MExAG also encourages NASA to consider, in collaboration with the scientific community, a comprehensive set of policy initiatives to develop effective implementations that both encourage greater openness and interoperability, while balancing the potential for increased costs and stress on the R&A programs. Such steps should also include an assessment of how SPD-41 implementation differentially impacts various elements of the community as well as how to implement a process that is equitable in its expectations and burdens.

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.

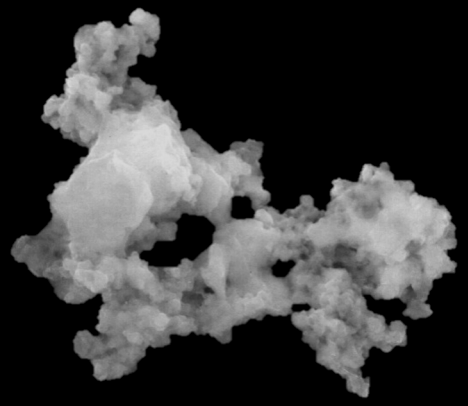
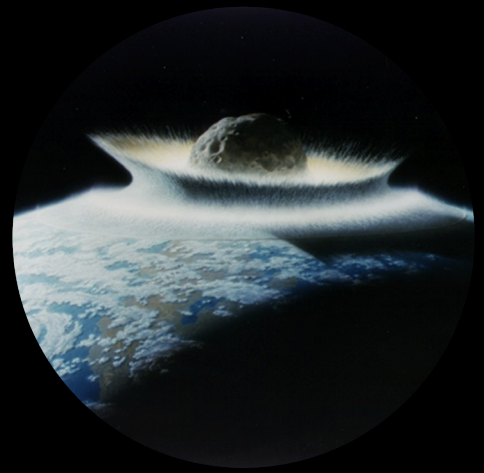
Upcoming Mercury Meetings and Events

- LPSC, 7–11 March 2022
- Mercury 2022: Current and future science of the innermost planet, 7–10 June 2022, Orléans, France
  - Continuation of meetings to bring together MESSENGER, BepiColombo, and broader Mercury science communities
- BepiColombo:
  - Mercury Flyby 2, 23 June 2022

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

Twitter: @ExploreMercury

SBAG



Bonnie J. Buratti, SBAG Steering Committee Chair

January 15, 2022 NASA Planetary Science Advisory Committee (PAC)

Virtual Meeting

www.lpi.usra.edu/sbag/

The Steering Committee

Present Steering Committee

Justin Atchison (JHU/APL) Technology Lead
Maitrayee Bose (Arizona State Univ.)
Bonnie Buratti (NASA JPL/Caltech), Chair
Michael Busch (SETI Inst.)
Terik Daly (APL), Early Career Secretary (rotated off)
Jessie Dotson (NASA Ames), Planetary Defense Lead
Henry Hsieh (Planetary Science Institute)
Mihaly Horanyi (Univ. of Colorado, Boulder)
Stephanie Jarmak (SWRI) Early Career Secretary (2.5 year term)
Stefanie Milam (NASA GSFC)
William O'Hara (Sierra Nevada Corp.), Human Exploration Lead
Jennifer Scully (NASA JPL/Caltech)
Timothy Titus (USGS, Flagstaff)

Thomas Statler NASA Headquarters Liaison
Jake Bleacher Human Exploration and Operations Mission Directorate (HEOMD) Liaison
Paul Abell (JSC) HEOMD Observer

Steering Committee selects Chair and Steering Committee members from among nominations, applications. General membership open.

Findings from SBAG Meeting #26 January 24-25, 2022

Requires action:

1. **SPD-41:** The SBAG community is in favor of enabling reproducible, open science through the release of newly generated codes and data that broadly benefit the community. However, due to the ambiguous language of SPD-41 and SPD-41a and likely unintended consequences, SBAG suggests that NASA incorporate more precise language and modifications into the policy before implementing it. The SBAG community points out that the policy as written may discourage collaborations and may disadvantage certain institutions. SBAG concludes that the intended and unintended consequences of the policy are poorly understood and may unintentionally impede scientific output. To this end, SBAG supports the creation of workshops or other initiatives to enable significant community and NASA HQ interaction, which will identify the consequences of the adopted SPD-41 policy and the proposed SPD-41a changes, with the goal of enabling effective implementation processes.

(https://www.lpi.usra.edu/sbag/findings/)

Findings from SBAG Meeting #26 requiring no action; these show continuing support from community

RADAR: SBAG commends NASA for supporting additional asteroid radar observations at other facilities in order to meet a portion of the scientific and planetary defense goals previously accomplished by the Arecibo Observatory. SBAG encourages NASA to continue planned upgrades to radar capabilities at the Goldstone and Canberra Deep Space Network sites, and recommends that NASA continue to work with NSF and other agencies to develop new planetary radar facilities. The current efforts to install a planetary radar system at the existing Green Bank Telescope are an example of how such collaborations can aid the development of additional planetary radar capabilities.

IDEA: SBAG supports the development and hosting of a website (similar to the SBAG and other AG websites) for the cross-AG IDEA Working Group to provide Inclusivity, Diversity, Equity, and Accessibility resources to the community. This website could provide easy access to resources such as best practices of equitable and inclusive procedures for hiring/selections and codes of conduct for conferences, teams, etc., which will benefit the community.

NEO SURVEILLANCE MISSION: SBAG congratulates NASA and its partners on bringing the NEO Surveillance Mission to its present level of development. Past SBAG findings and the National Academies of Science, Engineering, and Medicine's Finding *Hazardous Asteroids Using Infrared and Visible Wavelength Telescopes* have emphasized the importance of a space-based near-infrared asteroid survey mission, and we reiterate that support once more. NEOSM would provide a major contribution towards fulfillment of the George E. Brown Congressional goal of discovering 90% of the near-Earth asteroid (NEA) population larger than 140 meters in size, while characterizing the diameters of a significant fraction of that NEA population. Additionally, NEOSM would provide a dataset important for small-body science, human exploration, and resource utilization. SBAG encourages NASA's continued commitment to the mission and cadence of activities necessary to support the 2026 launch of NEO Surveyor.

Update: 99942 APOPHIS SPECIFIC ACTION TEAM (SAT) selected and met

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;

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

August 15, 2022 report target due date.

Other activities: Early career initiatives and Planetary Protection

1. SBAG has implemented a number of additional Early Career initiatives under the leadership of Stephanie Jarmak and Terik Daly. These include slack channels for discussion prior to and during SBAG meetings, and one-on-one mentoring programs during meetings. Current initiatives also include lightning talks and Early Career talks

2. SBAG was approached by NAS **Committee on Planetary Protection to give an overview of Planetary Protection during its 2021 Fall Meeting on December 1, 2021. Steering Committee Member Stefanie Milam gave presentation with the conclusion that f**urther study is needed with broader community input. SBAG hasn't been tasked by NASA to continue this work.

Summary

1. SBAG appreciates the support from the PAC and NASA on the creation for the 99942 APOPHIS SPECIFIC ACTION TEAM (SAT). It is now active and working.

2. The only finding that requires action is SBAG's concern over SPD-41. As written, it may impede scientific investigations. Additional community study through workshops and input is needed.

3. SBAG is giving continued support to additional asteroid radar observations at other facilities in order to meet a portion of the scientific and planetary defense goals previously accomplished by the Arecibo Observatory; IDEA initiatives; and the advance of the NEO Surveillance Mission including a 2026 launch of NEO Surveyor.

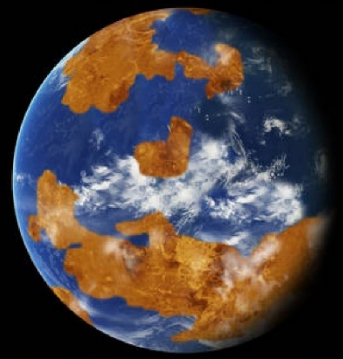

VEXAG

VEXAG update February 15, 2022

VENUS EXPLORATION VEXAG ANALYSIS GROUP

Darby Dyar	*PSI, Mount Holyoke College*, Chair
Noam Izenberg	*Applied Physics Laboratory*, Deputy Chair
Jeff Balcerski	*Ohio Aerospace Institute*
Paul Byrne	*North Carolina State University*, Early-Career Representative
Natasha Johnson	*NASA GSFC*
Stephen Kane	*University of California at Riverside*
Pat McGovern	*Lunar & Planetary Institute*
Molly McCanta	*University of Tennessee*
Jason Rabinovich	*Stevens Institute of Technology*
Jennifer Whitten	*Tulane*, Early-Career Representative
Siddarth Krishnamoorthy	*Jet Propulsion Laboratory*, Early-Career Representative
Sara Port	*Glenn Research Center*, Early-Career Representative
Debra Buczkowski **	*Applied Physics Laboratory*
Chuanfe Dong **	*Princeton University,* , Early-Career Representative
Megan Ansdell	*NASA HQ*, ex officio

VENUS



THE ORIGINAL OCEAN WORLD

VEXAG 2021

The 19th Meeting of the Venus Exploration Analysis Gorup

- Virtual 150+ in attendance over 2 days
  - Primers, flash talks, posters
  - Introduction of 3 New Venus Missions

SAW 1: Organization Documentation
SAW 2: VEXAG 2022 Meeting
SAW 3: Exoplanets in our Backyard (2022)
SAW 4: Venus Flyby & Opportunistic Science
SAW 5: Venus Science Nuggets
SAW 6: Surface Platform Study COMPLETE
SAW 7: Technology & Laboratory studies
SAW 8: Outreach/Advocacy
SAW 9: Social Media
SAW 10:VEXAG Website
SAW 11: IDEA
SAW 12: Aerial Platform Science and Technmology

- 11 Findings, 3 detailed for PAC:

VEXAG 2021 Findings for PAC

Finding 1:

VEXAG is pleased that there are new Venus missions, and is are positioning to welcome and advocate for a much larger international Venus community. Nonetheless, we recognize that there are still many outstanding Venus questions that cannot be addressed by the current suite of missions, so future Venus flagship, New Frontiers, and ride-along mission(s) and a Venus program remain high priorities.

VEXAG finds that NASA should: 1) establish a formal Venus Program within SMD as part of this effort; 2) retain Venus as a target for future New Frontiers opportunities.

VEXAG 2021 Findings for PAC

Finding 3:

Methods to provide long-term power to Venus surface assets have been studied extensively, including the Venus Surface Platform Study. However, other than radioisotopic nuclear power, there exists no clear long-term solution for providing power for mobility and/or temperature control for weeks, months, or even longer. This long-term capability is critical for answering key science questions (cf. the VEXAG GOI, but this is a multi-AG issue). Given that the development of such capability is expected to take a decade at a minimum –

VEXAG finds that NASA STMD should restart the assessment and development of long-duration power systems generally, including those that can directly be applied to Venus exploration.

VEXAG 2021 Findings for PAC

Finding 11:

There are concerns about the safety of LPSC attendees, and a desire to make LPSC accessible to a broader geographic range of people. There is no longer a proximal/historical association between LPSC and JSC that constrains the conference's location. Between 30 and 40% of LPSC attendees are students for whom location is critically important.

VEXAG finds that the location of the LPSC conference should be rotated away from Texas beginning in 2023.

VEXAG 2022 Calendar

- LPSC 2022
  - **VEXAG has created a Student Travel Grant to supplement higher registration costs for up to 10 undergraduates and Post-Bacs presenting Venus science at LPSC.**
  - No LPSC town hall, but virtual one planned for April, 2022
  - 2 Venus Oral Sessions, 1 Poster and 2 IPoster sessions, 50 Student abstracts.
- LPI Venus Initiative, Ancient Venus May 2-4 2022.
- VEXAG 2022: live/hybrid at Caltech, November 7-9 2022
- Exoplanets in our Backyard 2: live/hybrid at Caltech, November 9-11 2022


MEPAG

MEPAG Report to Planetary Science Advisory Committee

R Aileen Yingst, Chair

15 February 2022

Clouds over Mont Mercou, Gale crater, Mars. Image credit: NASA/JPL-Caltech/MSSS

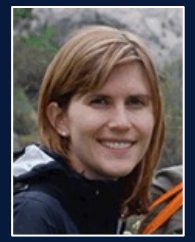
MEPAG Programmatics

- Steering Committee (Chair: R. Aileen Yingst (PSI), appointed June 2019)
  - W. Calvin (Univ. Nevada Reno)
  - B. Horgan (Purdue)
  - D. Banfield (Cornell)
  - J. Filiberto (LPI; IDEA representative)
  - C Dundas (USGS)
  - S. Hubbard (Stanford University)
  - S.S. Johnson (Georgetown University)
  - K. Lynch (LPI; IDEA representative)
  - J. Johnson (past Chair, JHU/APL)
  - M. Meyer (NASA HQ)
  - D. Beaty, R. Zurek, M. Mischna (JPL)
  - J. Bleacher/P. Niles (HEOMD, NASA HQ) Ex Officio members
- Goals Committee (D. Banfield, Chair)
  - Goal I *<Life>* (J. Stern, GSFC; A. Davila, ARC)
  - Goal II *<Climate>* (D. Brain (Univ. Colorado), Claire Newman (Aeolis Research))
  - Goal III *<Geology>* (C. Viviano, APL, Becky Williams, PSI)
  - Goal IV *<Human Exploration>* (J. Bleacher, NASA HQ HEOMD; M. Rucker, P. Niles JSC)

Mars Exploration Program Analysis Group (MEPAG)

Steering Committee

R. Aileen Yingst
PSI
MEPAG Chair



Sarah Stewart Johnson
Georgetown

Jeff Johnson,
JHU/APL
Past Chair

Don Banfield
Cornell U.

Goals Comm. Chair

Wendy Calvin
UNR

Scott Hubbard
Stanford U.

Colin Dundas
USGS

Briony Horgan
Purdue

Justin Filiberto
LPI
IDEA Rep

Kennda Lynch
LPI
IDEA Rep

Michael Meyer
NASA HQ

Michael Mischna
MPO/JPL

Jake Bleacher
NASA HQ

Dave Beaty
MSR/JPL

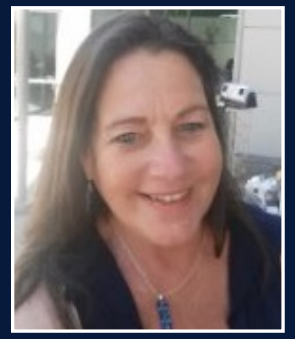
Paul Niles
JSC

Rich Zurek
MPO/JPL

Mars Program Office associates

(Jet Propulsion Laboratory)

Brandi Carrier



Barbara Saltzberg

Jonathan Bapst

Sona Hosseini

MEPAG Summary (from VM14 mtg, 2-3 February 2022)

- MEPAG congratulates the active, cutting-edge science being accomplished by the current Mars missions. These represent a strong international presence and interest in Mars. We encourage cooperation among missions across international boundaries to maximize science from these opportunities.
- MEPAG applauds the productivity of ongoing missions and encourages NASA to continue support of these missions in a way that ensures crucial capabilities (e.g., resolution, overflight times, etc.) are not lost because of the pressures of new requirements (e.g., PDS4, cybersecurity) or further budget cuts.
- MEPAG eagerly awaits the report of the iMIM Measurement Definition Team, which is deep in deliberation.
- Following the release of the Decadal Survey, MEPAG is prepared to support the Mars Exploration Program in informing pathways to definition and implementation of other science missions in parallel with MSR.


MAPSIT

Mapping and Planetary Spatial Infrastructure Team (MAPSIT)

Report to Planetary Advisory Committee (PAC)
Feb 15, 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)

Dani DellaGiustina (Univ. Arizona)

Sander Goossens (NASA Goddard)

Justin Hagerty (USGS), *Ex Officio*

Trent Hare (USGS)

Jay Laura (USGS)

Sam Lawrence (JSC), HEOMD 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.)

* = new SC members

MAPSIT Findings (1/3)

MAPSIT welcomes the appointment of Dr. Moses Milazzo, the first Chief Scientist for the Planetary Data Ecosystem

- This position is an outgrowth of Independent Review Board's (IRB) report for the Planetary Data Ecosystem (PDE).
- This newly created role provides an independent link between the larger PDE community, the Planetary Data System (PDS) and NASA Headquarters, and also refines and represents the PDE to NASA.
- Previously, the PDS Chief Scientist was an Ex Officio member of MAPSIT

Source: https://www.nasa.gov/feature/nasa-selects-first-chief-scientist-for-the-planetary-data-ecosystem

MAPSIT Findings (2/3)

MAPSIT endorses the final report of the Lunar Critical Data Product Special Action Team (LCDP-SAT), a joint LEAG-MAPSIT committee headed by Drs. Julie Stopar and Angela Stickle

Final report published on MAPSIT website:
https://www.lpi.usra.edu/mapsit/reports/
https://www.lpi.usra.edu/mapsit/reports/leag_mapsit_report_2022-01-11.pdf

MAPSIT Findings (2/3)

LCDP-SAT outcomes include specific findings in the following areas:

- Lunar Coordinate Systems and Frames
- Critical New Foundational Data Products for the South Pole
- Critical New Derived Data Products for Near-Future Missions to the South Pole
- New Mission-Enabling Data and Products for Further Lunar Exploration
- Lunar Data and Tools
- Realize a Lunar Spatial Data Infrastructure (SDI)

- Next steps under consideration include establishing a lunar SDI Working Group (WG)

MAPSIT Findings (3/3): SPD-41, Scientific Information policy for the Science Mission Directorate

Positive elements:

III A. All SMD-funded publications, that is publications funded by SMD or reporting on SMD-funded research, shall be made publicly accessible.

a. As-accepted, peer reviewed manuscripts shall be deposited in NASA's PubSpace repository and made publicly available no-later than 12-months after their publication date

MAPSIT finding: This is in accordance with current best practices and aligns with FAIR data principals (i.e., to make data Findable, Accessible, Interoperable, and Reusable).

Source: https://science.nasa.gov/researchers/science-data/science-information-policy

MAPSIT Findings (3/3): SPD-41, Scientific Information policy for the Science Mission Directorate

Elements of concern:

- Although the goal of SPD-41 is laudable, some of the language remains vague. Multiple footnoted documents are lengthy; can be difficult to find all items relevant to a given topic.
  - For instance: Examples of acceptable repositories for software (§III.C) and for disability accessibility (§III.E) are not specified
- Multiple standards likely without additional funding. New data for extended missions are mandated to be in PDS4 format. Large, computationally-intensive data sets may be expensive to convert from PDS3 format. Historically, overguide options (as proposed in the Planetary Mission Senior Review for PDS3 archive conversion) are rarely funded.

Source: https://science.nasa.gov/researchers/science-data/science-information-policy

Upcoming activities

- Two poster sessions at the Lunar and Planetary Science Conference (LPSC), Mon March 7 and Wed March 9 on “Planetary Data and Infrastructure: Build it and They Will Come”
- Planetary Geology Mappers’ Meeting will be held June 2022 in Flagstaff, AZ, hybrid format


ExMAG

Extraterrestrial Materials Analysis Group (ExMAG)

PAC meeting, February 2021

Jemma Davidson, Vice Chair
ExMAG.community@gmail.com

ExMAG membership

ExMAG STEERING COMMITTEE

ExMAG Chair
Barbara Cohen

Astromaterials Curator
Francis McCubbin

NASA HQ Liaison
Jeff Grossman

Exploration Hardware Subcommittee
Space-exposed hardware collections, future hardware
Rhonda Stroud, acting

Chair:
Barbara Cohen (GSFC)

Members:
Jemma Davidson (ASU), Vice-Chair
Emma Bullock (CIW), Secretary
Jessica Barnes (U Arizona)
Kate Burgess (NRL)
Justin Filiberto (LPI)
Jon Friedrich (Fordham)
Juliane Gross (Rutgers)
Pierre Haenecour (U Arizona)
Lydia Hallis (U Glasgow)
Munir Humayun (FSU)
Manavi Jadhav (ULL)
Rhiannon Mayne (TCU)
Larry Nittler (CIW)
Caroline Smith (NHM London)
Rhonda Stroud (NRL)

Lunar Sample Subcommittee
Apollo samples, Artemis sample planning
Jessica Barnes

Mars Sample Subcommittee
MMX and Mars Sample Return planning
Justin Filiberto and Caroline Smith

Microparticle Subcommittee
Cosmic Dust, Stardust mission, microparticle impacts
Rhonda Stroud

Asteroid Subcommittee
Hayabusa, Hayabusa-2, OSIRIS-Rex
Munir Humayun

Meteorite Subcommittee
Antarctic meteorites
Jon Friedrich

Genesis Subcommittee
Genesis mission
Larry Nittler

Facilities and Informatics Subcommittee
Sample curation facilities, databases, and catalogs
Rhiannon Mayne and Pierre Haenecour

ExMAG activities

- Website – https://www.lpi.usra.edu/exmag/
  - Check it out! Carried over CAPTEM meeting minutes and publications.
  - Twitter: @ExMAG_community
- Membership
  - We recruited three new exec. comm. members (secretary, two at-large members, inc. IDEA rep.), two lunar subcommittee members, one microparticle subcommittee member.
  - Targeted early-career opportunities.
- Lunar Subcommittee
  - Analysis of best practices for additional Luna samples.
  - Representation at LEAG for joint international sample efforts.
- Meteorite Subcommittee
  - Met with NSF and ANSMET to understand when activities will resume in the Antarctic.
- Mars Subcommittee
  - Setting up joint activities with MEPAG related to MSR planning and sample analysis needs.
- Facilities and Informatics Subcommittee
  - Newly reconstituted; looking at upcoming needs (e.g., SPD-41, PMEF).

ExMAG activities

- Community feedback for SPD-41, looking forward to engaging on Planetary Data Ecosystem activity to include issues and topics specific to sample analysis that have not been considered so far.
- Interested in knowing more about the NoDD programs, what is being submitted and funded, are sample-based research and facilities being funded appropriately. If PAC / other AGs are looking at these program statistics we'd like to help/join.
- Spring Meeting - Virtual, April 13-14 2022
  - Focused on curation and collections reports
  - Lightning science talks that highlight the various collections
  - Findings will be briefed to PAC

Re-amplifying Spring Meeting 2021 Finding, again

Chang'E-5 Sample Availability

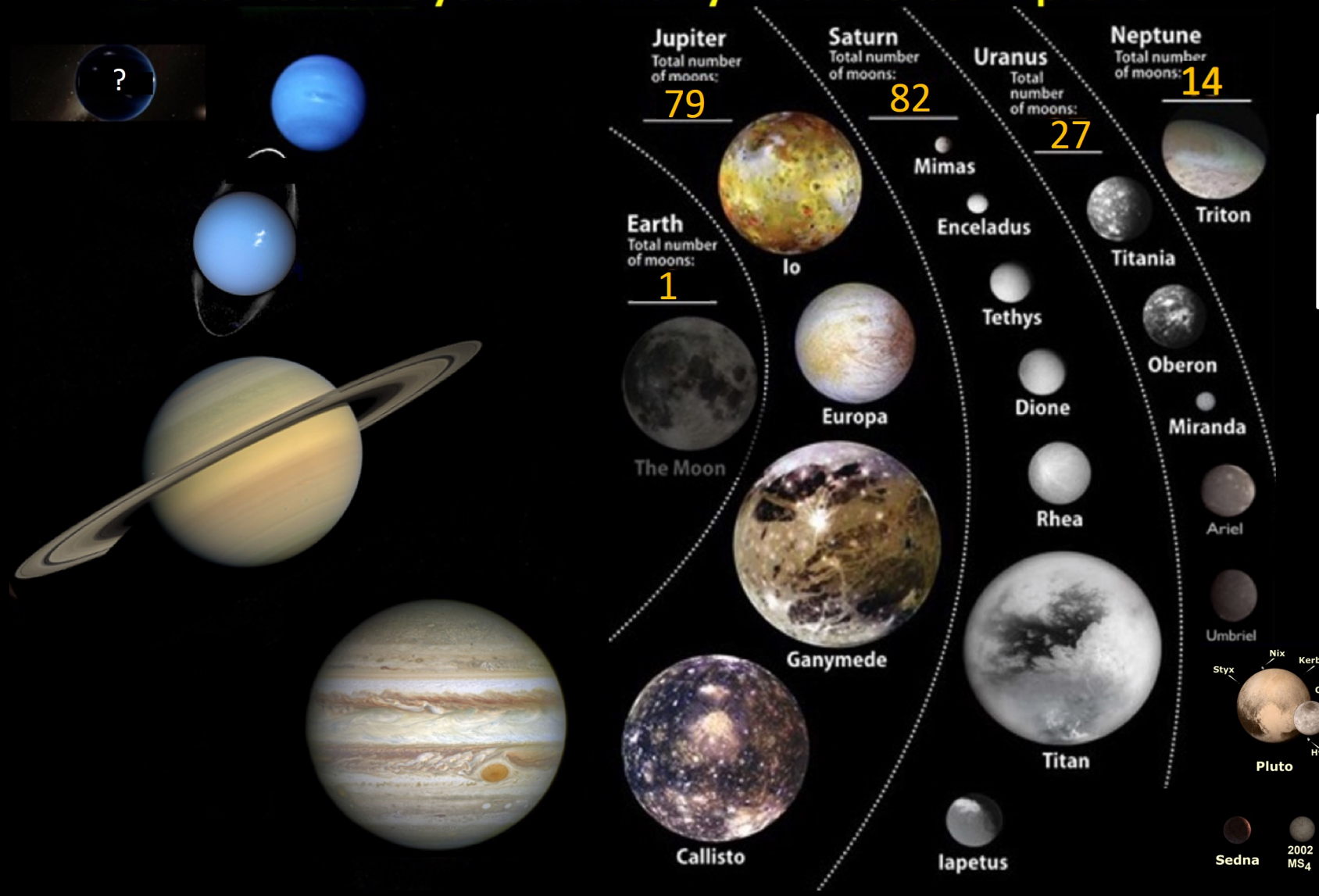
- The successful Chang'E 5 mission has returned the first new lunar sample return in decades. The samples' source is a unique location, a young mare basalt far from previous collection sites, holding the potential to dramatically change our understanding of solar system volcanic and impact history. NASA-funded researchers have a strong interest in working with these samples but understand that their collaboration with the People's Republic of China (PRC) is constrained by the Wolf Amendment, a Congressional limitation prohibiting bilateral exchanges between NASA-funded scientists and scientists and institutions in the PRC. Science is an international effort that is hindered when individuals face barriers to fully participating in science because of national policies. While recognizing that the US State Department has flagged human rights issues in the PRC as an area of concern, a scientific exchange similar to that conducted by the US and Soviet Union on Luna and Apollo samples in the 1970s could encourage scientific knowledge exchange to foster openness and diplomacy. Under current policy, Chinese national scientists are disallowed from receiving Apollo sample loans from the US collection. **ExMAG encourages NASA to explore a path to permit sample exchange and reciprocal sample loans between NASA and CNSA for the Chang'E-5 and Apollo samples** specifically, and potentially to broaden such a program to encompass the substantial Antarctic meteorite collections of both nations and future sample-return missions. Such an exchange would also alleviate individual researchers' concerns about working with Chang'E-5 samples using NASA funding, which could constitute a violation of the Wolf Amendment. *(endorsed by LEAG)*


OPAG

OPAG Update to the Planetary Science Advisory Committee (PAC)

Linda Spilker (JPL), Jeff Moore (NASA ARC), OPAG Co-Chairs, PAC Meeting, 15 February 2022

Outer Solar System: Many Worlds to Explore



OPAG *is* the Comparative Planetology AG

Large KBOs:

Recent and Upcoming OPAG-related Meetings

Recent Meetings

- **Town Hall at AGU** (Thursday, 16 December 2021 from 11:15 – 12:15 CST)

Upcoming Meetings

- **OPAG representation at LPSC for any questions or comments** (March 2022)

- **Spring OPAG Meeting Meeting*** (19 – 21 April 2022) (Hybrid)
  - Focus on Planetary Science and Astrobiology Decadal Survey report

  * Meeting may be delayed if release of Decadal survey is further delayed

Summary of OPAG August 2021 Findings (3) and PAC Responses

1. Status of RPS Development and Production (see details in backup slides)

   After his presentation on RPS program at the November PAC meeting, Len Dudzinski agreed in the Q&A period to provide a schedule of deliverables to address OPAG's finding. (*Status of schedule?)**

   PAC agreed to revisit and review timeline after decadal survey is released. (Decadal not yet released)

2. Cost Provisions and Radioisotope Power for Future Discovery and New Frontiers AOs

   PAC is supportive of excluding Phase E costs from NF and Discovery to "level the playing field" between missions, and will revisit if the Phase E cost is no longer excluded in a future AO

3. Schedule for Future Discovery and New Frontiers AOs

   PAC members agreed that a good understanding of the Discovery and NF AO schedules is important

* Question about status of item from last PAC meeting

Backup Slides

- Findings summaries
- Full text of OPAG findings can be found at:
  https://www.lpi.usra.edu/opag/meetings/aug2021/OPAG-August-2021-Findings.pdf

Request for PAC Advocacy:

1. **Status of RPS Development and Production**

- **Preamble**: Recent presentation by June Zakrajsek provided status of Radioisope Power Systems (RPS) Program
- **Finding:** RPS units are essential for outer planet missions.
- OPAG requests NASA to commit to preparing and fueling RTG units for the next decade to meet the science needs of entire planetary exploration community.
- Announce how many RTG units of each type will be prepared as well as timeline for their development over at least the next decade.
- RPS production plan for the next decade: including one flagship mission (three NextGen units), two NF missions (up to two NextGen units each), and at least one Discovery mission.
- OPAG further urges NASA to commit to a timely development of the higher power Next Gen Mod 2 RTG in support of additional missions beyond the early 2030s.

Request for PAC Advocacy:

2. **Cost Provisions and Radioisotope Power for Future Discovery and New Frontiers AOs**

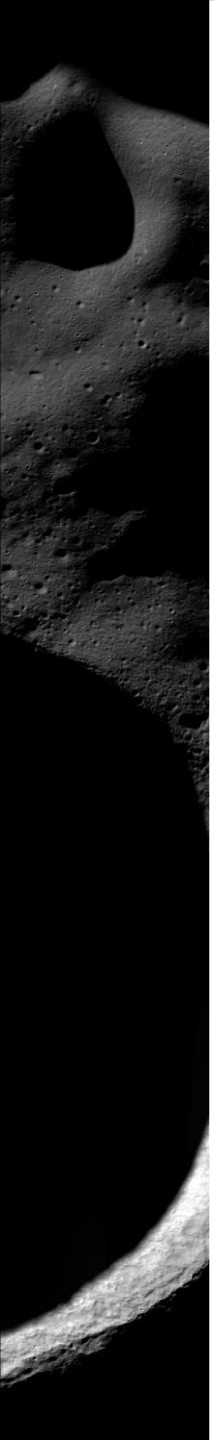
- **Preamble:** Two finalists for Discovery 2020 were Io Volcano Observer (IVO) and Trident. Dragonfly was selected for New Frontiers 4.
- Mission concepts were enabled by provisions to exclude launch vehicle and Phase E expenses (operations and science post-launch) from cost cap.
- Further enabled by making Radioisotope Power Systems available (needed by Trident and Dragonfly).
- **Finding:** OPAG urges NASA to continue to exclude launch vehicle and Phase E costs from the cost cap of Discovery and New Frontier missions.
- OPAG also urges NASA to continue to make radioisotope power available in future Discovery and New Frontiers AOs.

Request for PAC Advocacy:

3. **Schedule for Future Discovery and New Frontiers AOs**

- **Preamble:** NASA recently delayed the NF-5 AO by approximately two years such that the schedule currently lists Discovery in 2023 and NF-5 in 2024, less than one year apart. Concern that Discovery schedule may be adversely impacted.
- Delay of NF-5 is also inconsistent with the two missions per decade cadence recommended by V&V Decadal survey
- **Finding:** OPAG requests no further delays to either the currently planned NF-5 or Discovery AO releases and to provide the NF-5 draft AO as soon as possible.
- Make every effort is made to "catch up" for delays in the current decade in order to stay on schedule with V&V Decadal recommended cadence of two New Frontiers missions per decade.
- OPAG further requests that NASA communicate updates to the expected AO release dates for the next Discovery and New Frontiers calls to the community as soon as possible to facilitate planning and ensure time for teams to prepare quality proposals.


LEAG

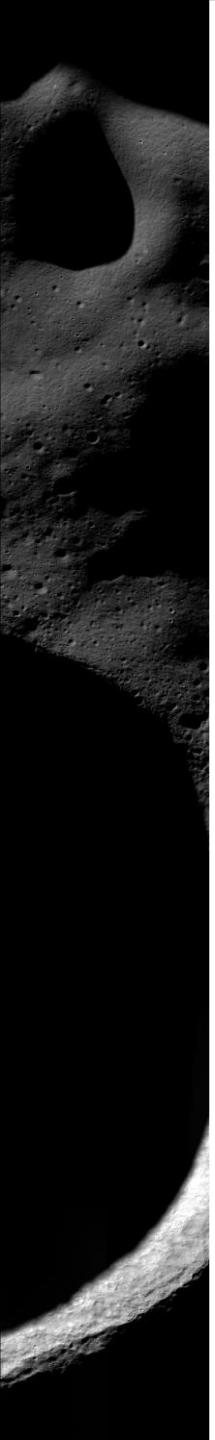


Lunar Exploration Analysis Group Updates

Dr. Jose M. Hurtado, Jr. (UTEP), LEAG Technology Chair

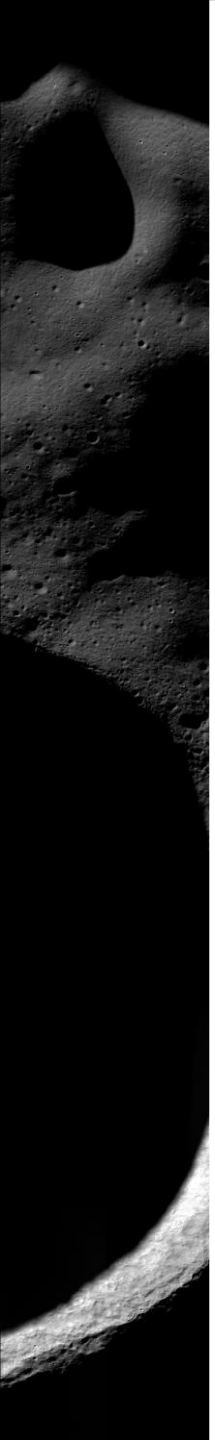
Presented to NASA Planetary Advisory Committee

15 February 2022



2022 LEAG Annual Meeting Save-the-Date

- **August 23-26**
  - In person meeting at Johns Hopkins University Applied Physics Laboratory
  - There will also be a virtual component

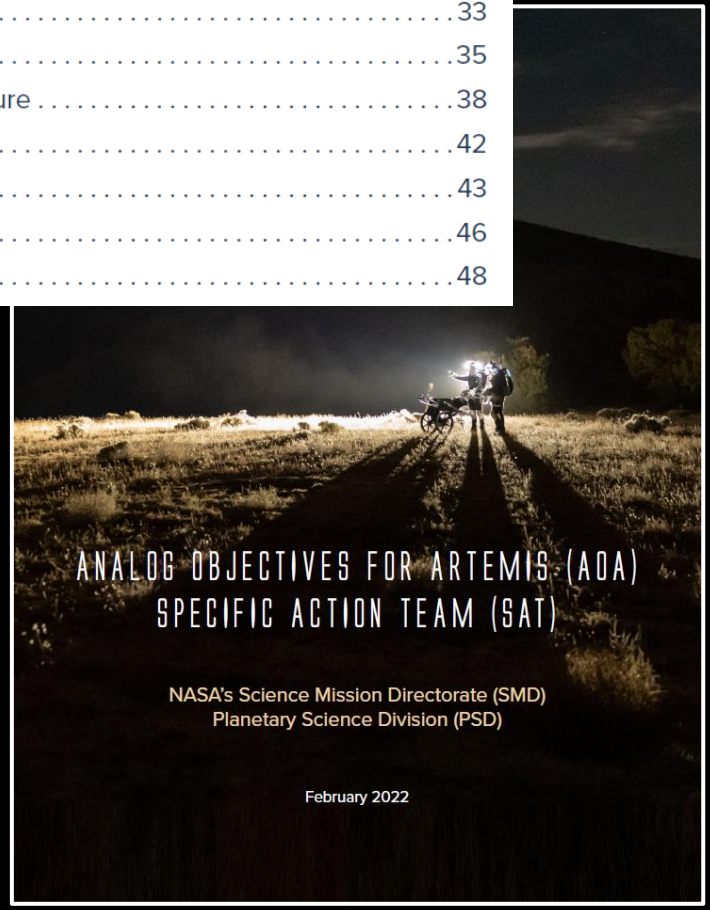


LEAG Activities since November 2021 (last PAC update)

- **New Strategic Roadmap Chair**
  - **Dr. Ben Bussey** (Johns Hopkins Univ. Applied Physics Laboratory)
- **Analog Objectives for Artemis Specific Action Team (AOA-SAT) [Dec. 2021-Jan. 2022]**
  - Requested by NASA Science Mission Directorate Planetary Science Division
  - Chair: **Kelsey Young** (NASA Goddard)
    - Other Members: **Jose Hurtado** (Deputy Chair, Univ. of Texas El Paso); **Jessica Barnes** (Univ. of Arizona); **Ben Feist** (Jacobs/NASA JSC); **Trevor Graff** (Jacobs/NASA JSC); **Jennifer Heldmann** (NASA Ames); **Nick Schmerr** (University of Maryland College Park); **Gordon Osinski** (University of Western Ontario); **R. Aileen Yingst** (Planetary Science Institute)
  - Final Report Submitted January 31, 2022
- **Continuous Lunar Orbital Capabilities SAT (CLOC-SAT) [Jan. 2022-Aug. 2022]**
  - Co-Chairs: **Ben Greenhagen** (Johns Hopkins APL) and **Carle Pieters** (Brown Univ.)
    - Other Core members: **John Keller** (NASA Goddard), **Mark Robinson** (Arizona State Univ.), **Julie Stopar** (Lunar and Planetary Institute)
    - Public Kick-off Workshop February 15, 2022 (TODAY) with requests for additional community SAT members (due March 1, 2022) and white papers (due March 31, 2022)

AOA-SAT *Analogs Objectives for Artemis*

- **Rationale:** Provide NASA with an understanding of the needs and objectives of all stakeholders in human analog activities currently operating or being stood up in preparation for lunar surface Extravehicular Activity (EVAs).
- Cataloged and prioritized the analog objectives for science and science operations in preparation for Artemis human landings.
- Each analog objective category was defined, described, and also assigned:
  - Priority: Mission Required, Mission Enabling, Mission Enhancing
  - Time Criticality: First Crewed Artemis Surface Mission, Artemis Sortie Missions, Artemis Base Camp Missions
  - Relevant Analog Scenario, Scale, and Requirements

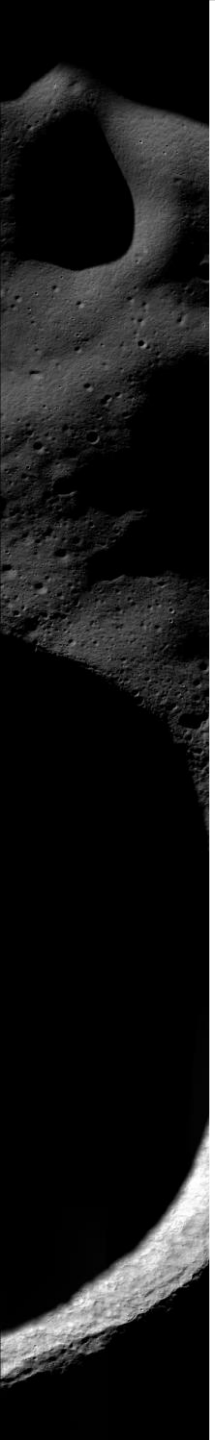


Final report submitted January 31, 2022
(will be publicly on LEAG website soon)

Dr. Jose Hurtado, on behalf of
Lunar Exploration Analysis Group

Given to NASA Planetary Science Advisory Committee

Tuesday, February 15, 2022



CLOC-SAT *Continuous Lunar Orbital Capabilities*

- **Rationale:** Develop integrated findings addressing questions associated with lunar orbital capabilities in the years ahead: **why** (rationale), **what** (specific needs/goals), and **how** (capabilities).

- Open call for membership on the SAT:
  - 2-page CV and 1-page statement of interest to clocsat@gmail.com by March 1, 2022
  - Aim is to have a more diverse SAT team, including members at various career stages

- **February**
  - Community Kick-off February 15th (TODAY)
- **March**
  - CLOC-SAT self-nominations close March 1st
  - Full team established around mid-March
  - White paper submissions close March 31st
- **April – July**
  - CLOC-SAT develops integrated strategy and recommendations from community input
  - Preliminary report findings presented at Exploration Science Forum in late July
- **August**
  - Revise drafts based on community feedback
  - Final report delivered to LEAG and NASA
  - Final report findings presented at LEAG Annual Meeting in late August

Dr. Jose Hurtado, on behalf of
Lunar Exploration Analysis Group

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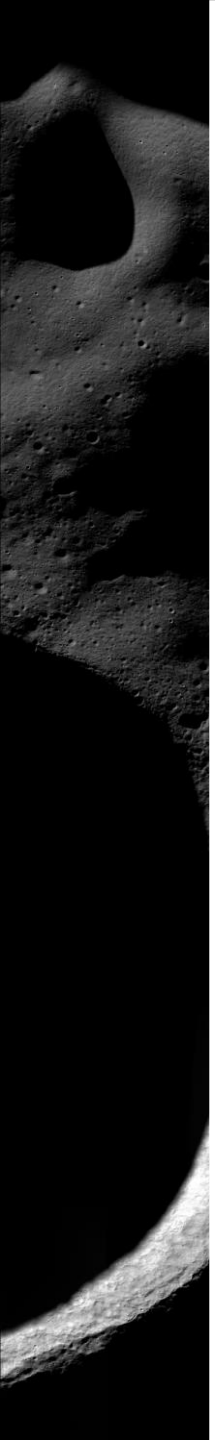
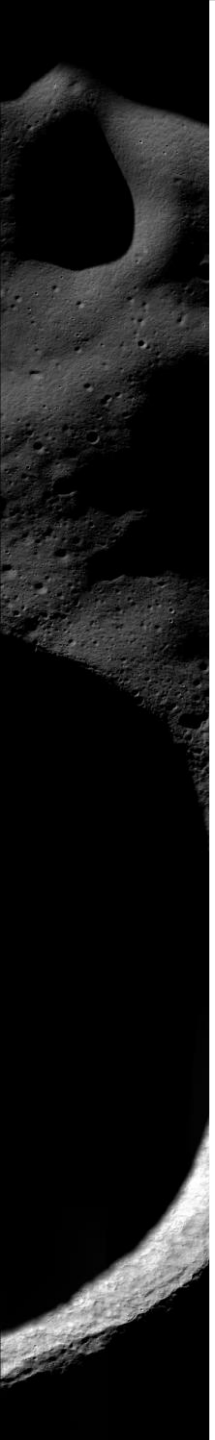


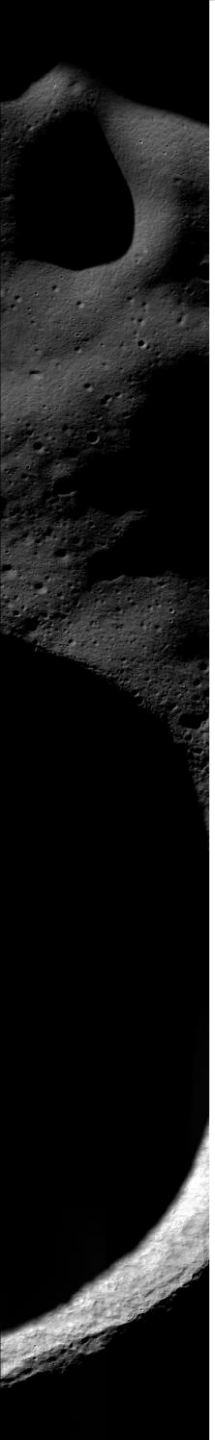
Additional Recent Lunar Activity

- **Inclusive Lunar Exploration Workshop, part of the Lunar Surface Science Workshop series [Jan 26-27 2022]**
  - Co-Chairs: **Kristen Bennett** (USGS) and **Parvathy Prem** (APL)
    - Day 1: Inclusion in the Lunar Workforce
      - **Key Finding:** ***Many solutions exist to promote inclusion and diversity in the workforce (see final report for details); in order for them to be implemented this work must be valued and funded.***
    - Day 2: Ethical and Accountable Lunar Exploration
      - **Key Finding:** ***There are a diverse range of thoughts related to this topic, which likely stems from the fact that the community has not yet spent much time considering these issues. There is great potential for progress on this topic and continued conversations on what responsible and ethical lunar exploration looks like would be valuable.***
  - Detailed key findings will be available upon completion of the workshop report (~mid-to-late March for draft and ~early April for final version).



LEAG Thanks the PAC for November 2021 Findings

- **Science-driven Leadership of Strategic SMD Missions**
  - "The PAC finds that **NASA should develop a broad lunar science and exploration strategy with a clear set of scientific priorities and a scientific leadership structure with the authority** to generate the science requirements for NASA's Artemis and CLPS programs. The lunar science leadership should be charged with driving a strategy for selecting CLPS science objectives, landing sites, and instrumentation."
- **Sharing of Lunar Samples with China**
  - "The PAC finds that **NASA should explore paths to enable sharing of lunar samples between China and the US** given the recent success of the Chang'E-5 sample return mission and the upcoming CLPS and Artemis missions."
- **Software/Data Management**
  - "The PAC recommends that NASA encourage all community Analysis/Assessment Groups (AGs) to include a data/software management representative in their steering committees, so that such a person can work with NASA and MAPSIT to be aware of resources, policies, and leading practices to better support their respective communities."

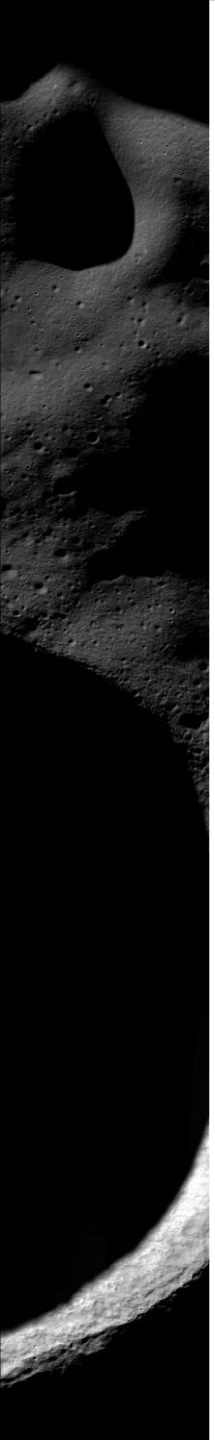


LEAG Action Requests to the PAC

Dr. Jose Hurtado, on behalf of
Lunar Exploration Analysis Group

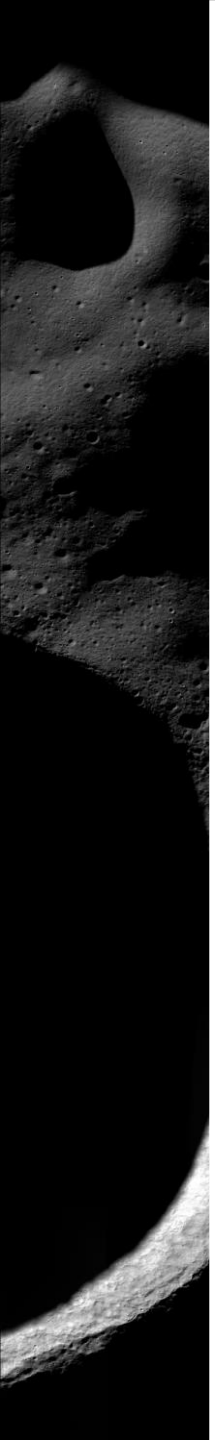
Given to NASA Planetary Science Advisory Committee

Tuesday, February 15, 2022



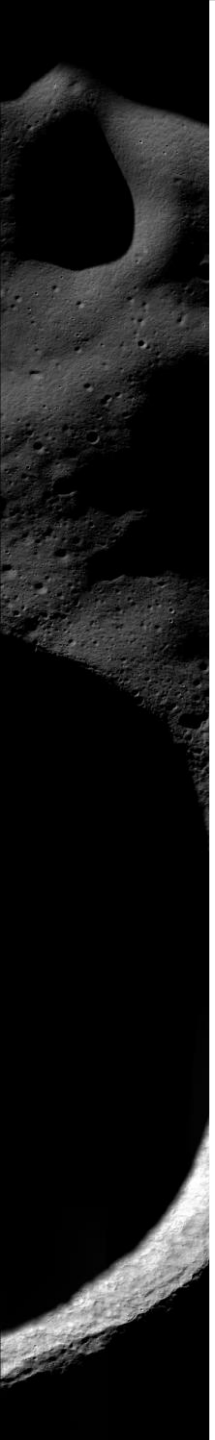
Action Request to the PAC : Recommend the development of a plan for continuous remote sensing assets around the Moon to achieve high priority science and exploration objectives.

- **Rationale #1: The Lunar Reconnaissance Orbiter (LRO) has been in operation around the Moon since 2009 and has provided a wealth of information about the Moon:**
  - Data volume delivered to the NASA Planetary Data System: >1.3 PB;
  - 5th extended mission proposal submitted January 2021;
  - Depending on orbital choices, only a few years of fuel left.



Action Request to the PAC : Recommend the development of a plan for continuous remote sensing assets around the Moon to achieve high priority science and exploration objectives.

- **Rationale #2: The LEAG community places high value on the development of an orbital plan to activate during LRO's tenure or after as noted in recent annual meetings and a new Specific Action Team:**
  - **2020 Finding 2.8:** *LEAG supports the definition of a long-term strategy to meet orbital remote sensing and other needs beyond the life of the 2009 Lunar Reconnaissance Orbiter. Specifically, LEAG encourages NASA to engage the community in this activity, provide details on trade studies to date, and evaluate a broad range of science and exploration use cases;*
  - **2021 Finding 2.2 :** *NASA should work with the community towards identifying and addressing all necessary remote sensing capabilities employed around the Moon (currently and in the future) to accomplish high-priority science and exploration objectives.*
  - **LEAG has established the Continuous Lunar Orbital Capabilities SAT (CLOC-SAT) to identify top investigations/measurements needed to address science and exploration goals.**



February 2022 LEAG Request Summary

- **We request that the PAC:**

  Recommend the development of a plan for continuous remote sensing assets around the Moon to achieve high priority science and exploration objectives.

LEAG stands ready to facilitate

Dr. Jose Hurtado, on behalf of
Lunar Exploration Analysis Group

Given to NASA Planetary Science Advisory Committee

Tuesday, February 15, 2022