

MExAG

Mercury Exploration Assessment Group

Presentation to NASA PAC

18 August 2020

Presenter: Steven A. Hauck, II (Case Western Reserve University)

Mercury Exploration Assessment Group (MExAG)

- Created in response to Feb 2018 PAC finding
- Strong interest (28 nominations) in Steering Committee participation from the community

▪ SC in place July 2020

Chair

Vice-Chair

Exosphere Discipline Member

Geochemistry Discipline Member

Geology Discipline Member

Geophysics Discipline Member

Magnetosphere Discipline Member

Early Career Member

Early Career Member

International Liaison

NASA Liaison

Steven A. Hauck, II (CWRU)

Carolyn Ernst (APL)

Ronald J. Vervack, Jr. (APL)

Kathleen Vander Kaaden (Jacobs/JSC)

Christian Klimczak (Georgia)

Catherine Johnson (UBC & PSI)

Gina DiBraccio (GSFC)

Ariel Deutsch (Ames)

Gangaki Poh (GSFC)

Suzanne Imber (Leicester)

Shoshana Weider (NASA HQ)

Near-term priorities

- Support for Decadal Survey White Papers
- Building the MExAG community
 - Communications Working Group
- Preparing for the first MExAG annual meeting and development of the first Goals Document
 - Operations Working Group

Decadal Survey White Papers

- Mercury-focused white papers: 6
- Additional papers that discuss Mercury: 37
- One title listed in the *Izenberg et al* white paper:
 - Planetary and Astrobiology Blank Papers: Science White Papers Cancelled or Downscaled Due to Direct Impact of COVID-19 and National-scale Civil Action
- A holistic, rather than a reductive keyword-based, approach to considering the content of all Decadal Survey inputs, including white papers, is essential when developing a scientific and exploration strategy for the next decade.
 - The white papers are an example of the interconnected nature of planetary science that cannot be reduced to keywords that match committee assignments.

Building and sustaining the MExAG community

- As a new group, MExAG is focused on nurturing an equitable, diverse, inclusive, accessible and sustainable approach to serving the needs of the community and NASA.
- Among the MExAG SC's first actions were:
 - Become an engaged participant in EDIWG
 - Creating a Steering Committee Code of Conduct WG
 - Begin drafting an SC code of conduct, including accountability mechanisms.
 - An additional goal is for the SC code to serve as a starting point for expectations for all MExAG interactions and meetings.

Upcoming Mercury Events

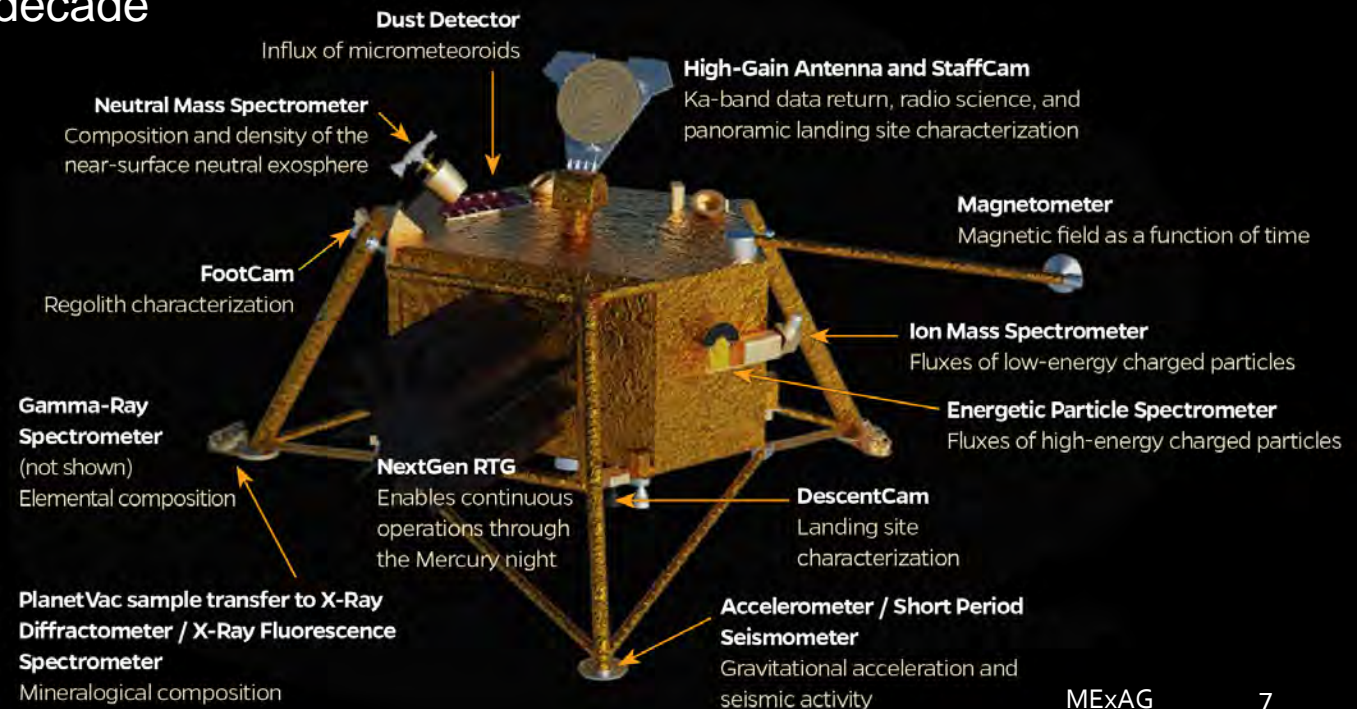
- EPSC: 21 September–09 October 2020
 - Mercury Science and Exploration Session: 36 presentations.
- AGU: 07–11 December 2020
 - Mercury: From MESSENGER to BepiColombo session
- Mercury 2021: 08–11 June 2021
 - Rescheduled from June 2020
 - 93 registrants for the meeting already
- 1st MExAG Annual Meeting: To be scheduled



Planetary Mission Concept Study



- Final report submitted 08 August 2020
- Addresses science goals encompassing geochemistry, geophysics, the Mercury space environment, and surface geology
- One full Mercury year (~88 Earth days) of surface operations with an ambitious, high-heritage, landed science payload
- Cost estimate demonstrates that a Mercury Lander mission is feasible and compelling as a New Frontiers-class mission in the coming decade



Observations

- MExAG welcomes NASA's concern about the impacts of COVID-19 through the expected creation of the ROSES SMD Post-COVID Recovery program element.
- However, MExAG also notes that the unexpectedly low funding rates in SSW from ROSES 2019, in combination with the ongoing pandemic and racial injustice, are a serious challenge to a robust science and exploration program, particularly for smaller communities such as that which studies Mercury.

ADDENDA

Mercury Specific Decadal Survey White Papers

On the Case For Landed Mercury Science (*Byrne et al*)

Science Opportunities offered by Mercury's Ice-Bearing Polar Deposits (*Deutsch et al*)

Fundamental and Interdisciplinary Questions Drive the Scientific Exploration of Mercury (*Hauck et al*)

Mercury's Low Reflectance Material - Evidence for Graphite Flotation in a Magma Ocean? (*Klima et al*)

Recommended laboratory and field studies ahead of future Mercury exploration (*Vander Kaaden et al*)

Mercury sample return to revolutionize our understanding of the solar system (*Vander Kaaden et al*)

Decadal Survey White Papers that Discuss Mercury – 1

Lunar Volatiles Orbiters — Paul G. Lucey

Science Case for Microwave Wavelength Measurements — Matthew Siegler

Mars as a "natural laboratory" for studying surface activity on a range of planetary bodies — Serina Diniega

Looking Back is Looking Forward: The Need for Retrospective Solar System Observations in Advance of Exoplanet Retrievals — Chester "Sonny" Harman

STRATOSPHERIC BALLOON PLATFORMS FOR PLANETARY SCIENCE — Tibor Kremic

Exploring Solar System Organic Chemistry Evolution through the Surfaces of Ceres and Large Asteroids — Marc Neveu

Venus Petrology: The Need for New Data — Alison R. Santos

The Science Case for Io Exploration — James Tuttle Keane

Energy Storage Technologies for Planetary Science and Astrobiology Missions — Ratnakumar Bugga

THE EVOLUTION OF SMALL BODY POPULATIONS: FROM PLANET MIGRATION TO THERMAL DRIFT FORCES — William F. Bottke

Planetary Science Priorities for the Moon in the Decade 2023-2032: Lunar Science is Planetary Science — Erica R. Jawin

EXPLORING THE BOMBARDMENT HISTORY OF THE MOON — William F. Bottke

X-ray Studies of Planetary Systems: A 2020 Decadal Survey White Paper — Jaesub Hong

New Approaches to Lunar Ice Detection and Mapping: The Scientific Importance of the Moon's Polar Ice Deposits — Paul O. Hayne

The Importance of Planetary Volcanism and Key Investigations for the Next Decade: Advancing our Understanding of Planetary Interiors, Surfaces, Atmospheres, and Habitability — Laura Kerber

Exogeoscience and its role in Characterizing Exoplanet Habitability and the Detectability of Life — Cayman T. Unterborn

Strength In Diversity: Small Bodies as the Most Important Objects in Planetary Sciences — Laura M. Woodney

Venus: a Natural Volcanological Laboratory — Patrick J. McGovern

Origin and Evolution of the Moon's Procellarum KREEP Terrane — Brad Jolliff

Science on the fly! The importance of Venus flyby observations — Candace Gray

Decadal Survey White Papers that Discuss Mercury – 2

GEOCHRONOLOGY AS A FRAMEWORK FOR INNER SOLAR SYSTEM HISTORY AND EVOLUTION – Barbara Cohen

Non-Robotic Science Autonomy Development – Bethany Theiling

Lunar Volatiles and Solar System Science – Parvathy Prem

Science and technology requirements to explore caves in our Solar System – Timothy Titus

In-Situ Crystallographic Investigations of Solar System Objects in the next Decade – D. Blake

SPACE WEATHERING ACROSS THE SOLAR SYSTEM: LESSONS FROM THE MOON AND OUTSTANDING QUESTIONS – Michelle Thompson

Assessing the Recent Impact Flux in the Inner Solar System: 1 Ga to Present – Becky Ghent

The Importance of Continuing Solar System-wide Impact Cratering Studies – Stuart Robbins

On the Past, Present, and Future Role of Biology in NASA's Exploration of our Solar System – Kevin Hand

Solar-System-Wide Significance of Mars Polar Science – Isaac Smith

The value of CHONS isotopic measurements of major compounds as probes of planetary origin, evolution, and habitability – Kelly Miller

Solar System Interiors, Atmospheres, and Surfaces Investigations via Radio Links: Goals for the Next Decade — SW Asmar

The Importance of Ground-Based Radar Observations for Planetary Exploration — Edgard G. Rivera-Valentín

Science Case for a Lander or Rover Mission to a Lunar Magnetic Anomaly and Swirl — David T. Blewett

Solar Array Technologies for Planetary Science and Astrobiology Missions — Joel A. Schwartz

High Priority Returned Lunar Samples — Sarah N. Valencia

Making Planets on Earth: How Experimental Petrology Is Essential to Planetary Exploration — Kayla Iacovino