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	**Steven A. Hauck, II** (CWRU)
Vice-Chair	**Carolyn Ernst** (APL)
Exosphere Discipline Member	**Ronald J. Vervack, Jr.** (APL)
Geochemistry Discipline Member	**Kathleen Vander Kaaden** (Jacobs/JSC)
Geology Discipline Member	**Christian Klimczak** (Georgia)
Geophysics Discipline Member	**Catherine Johnson** (UBC & PSI)
Magnetosphere Discipline Member	**Gina DiBraccio** (GSFC)
Early Career Member	**Ariel Deutsch** (Ames)
Early Career Member	**Gangaki Poh** (GSFC)
International Liaison	**Suzanne Imber** (Leicester)
NASA Liaison	**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

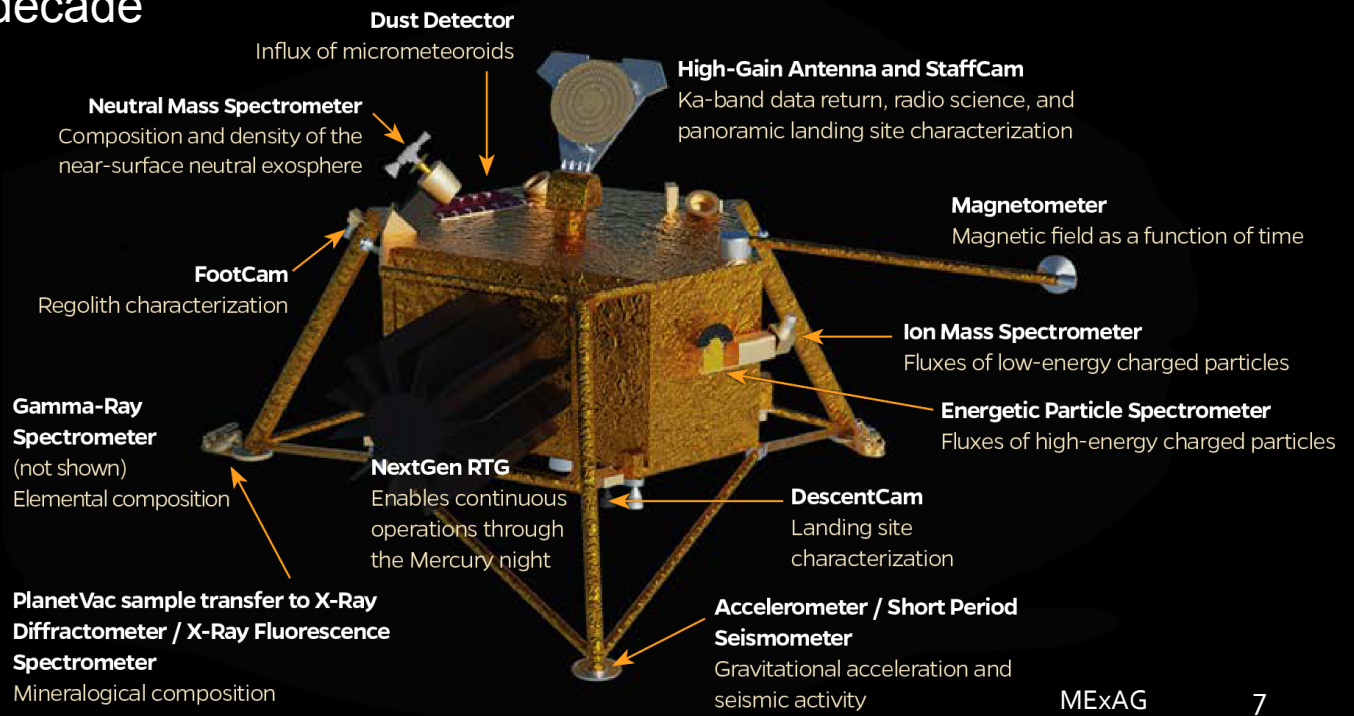
- As a new group, MExAG is focused on nurturing an equitable, diverse, inclusive, accessible and sustainable approach to serving the needs of the community and NASA.
- Among the MExAG SC's first actions were:
  - Become an engaged participant in EDIWG
  - Creating a Steering Committee Code of Conduct 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 Habitabilty 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 FRAMEWORKFOR INNER SOLAR SYSTEM HISTORYAND 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