



Status Report on the National Academies' Decadal Survey on Planetary Science and Astrobiology

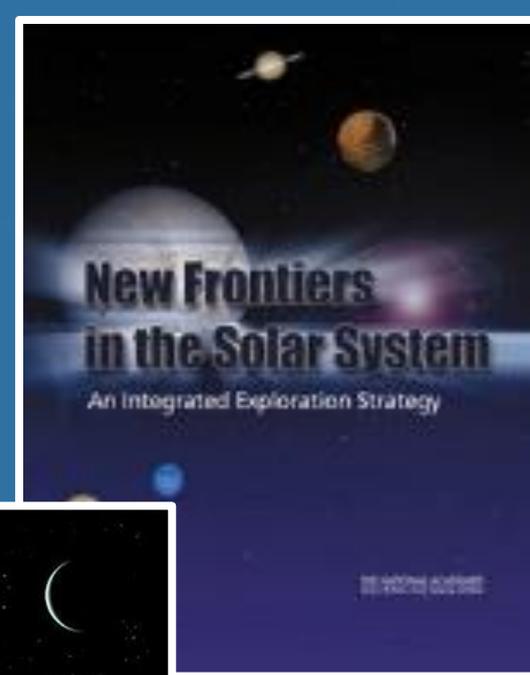
Co-chairs: Robin Canup and Phil Christensen
Study Director: David H. Smith

ExoPAG Meeting
6 January, 2021

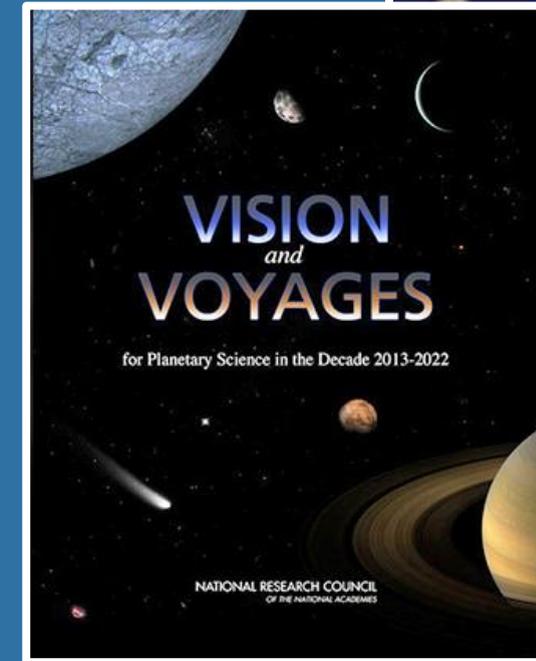
What is a Decadal Survey?

1. Assesses the current status of an entire scientific discipline
2. Defines and prioritizes key scientific questions to be addressed in the next decade
3. Prioritizes the most important initiatives to address these questions
4. Conducted by the National Academies, independently of sponsoring agencies
5. NASA Authorization Acts of 2005 and 2008 require decadal surveys in each NASA science area
6. Surveys include independent technical, risk, and cost evaluation of recommended projects/missions, as appropriate

Sponsoring agencies and Congress view surveys as the formal statement of priority by the US space science community, and have repeatedly stated their intent to give highest priority to the missions identified in the survey



2003-2012



2013-2022

Process is Driven by the Statement of Task

- Posted on the survey's website: <https://www.nas.edu/planetarydecadal>
- Outlines exactly what the sponsors—NASA and NSF—and the National Academies want the survey committee to do
- Additional information (e.g., scope, considerations, and approach) provides suggestions to make the survey most useful to NASA and NSF



What is New this Time?

- A higher profile for astrobiology and planetary defense
- More prominence given to decision rules to accommodate significant deviations in budget, new discoveries, and/or technological development
- Connection to human exploration activities undertaken by NASA and international partners
- Identification of opportunities for multidisciplinary collaboration within NASA, between NASA and NSF, and with other federal agencies, international partners and the private sector
- Consideration of issues related to the state of the profession



Role of Exoplanet Science

- From Scope:

“Recommendations for ground- and space-based investigations to detect exoplanets are out of scope (these topics are being addressed by ASTRO2020: Decadal Survey on Astronomy and Astrophysics currently in progress). However, the identification of scientific issues and questions related to the study of exoplanets, including the comparative planetology and potential habitability of solar and extrasolar planets, is in scope.”

- From Statement of Task:

“Opportunities for collaborative research that are relevant to science priorities between SMD’s four science divisions (for example, comparative planetology approaches to exoplanet or astrobiology research) ...”



Steering Group

Robin Canup, NAS, co-chair	Southwest Research Institute
Philip Christensen, co-chair	Arizona State University
Mahzarin Banaji, NAS	Harvard University
Steven Battel, NAE	Battel Engineering
Lars Borg	Lawrence Livermore National Laboratory
Athena Coustenis	Paris Observatory
James Crocker, NAE	Lockheed Martin Space Systems, Retired
Brett Denevi	Applied Physics Laboratory
Bethany Ehlmann	California Institute of Technology
Larry Esposito	University of Colorado
Orlando Figueroa	Orlando Leadership Enterprise LLC
John Grunsfeld	Endless Frontiers Associates LLC
Julie Huber	Woods Hole Oceanographic Institution
Krishan Khurana	University of California, Los Angeles
Barbara Sherwood Lollar	University of Toronto
William McKinnon	Washington University
Francis Nimmo, NAS	University of California, Santa Cruz
Carol Raymond	Jet Propulsion Laboratory
Amy Simon	NASA, Goddard Space Flight Center

- Survey leadership group
- Expertise spans scientific, technical, policy and programmatic scope of Statement of Task
- Responsible for overall conduct of survey
- Formulate top-level conclusions and recommendations



Panels Organized by Destination

Moon and Mercury

chair: Timothy Grove, vice chair: Brett Denevi

Venus

chair: Paul Byrne, vice chair: Larry Esposito

Mars

chair: Victoria Hamilton, vice chair: Bethany Ehlmann

Small Bodies

chair: Nancy Chabot, vice chair: Carol Raymond

Giant Planet Systems

chair: Jonathan Lunine, vice chair: Amy Simon

Ocean Worlds and Dwarf Planets

chair: Alex Hayes, vice chair: Francis Nimmo

- Provide targeted scientific and engineering expertise
- Each vice chair is also a member of the steering group
- Panel boundaries are permeable to encourage cross-panel discussions.

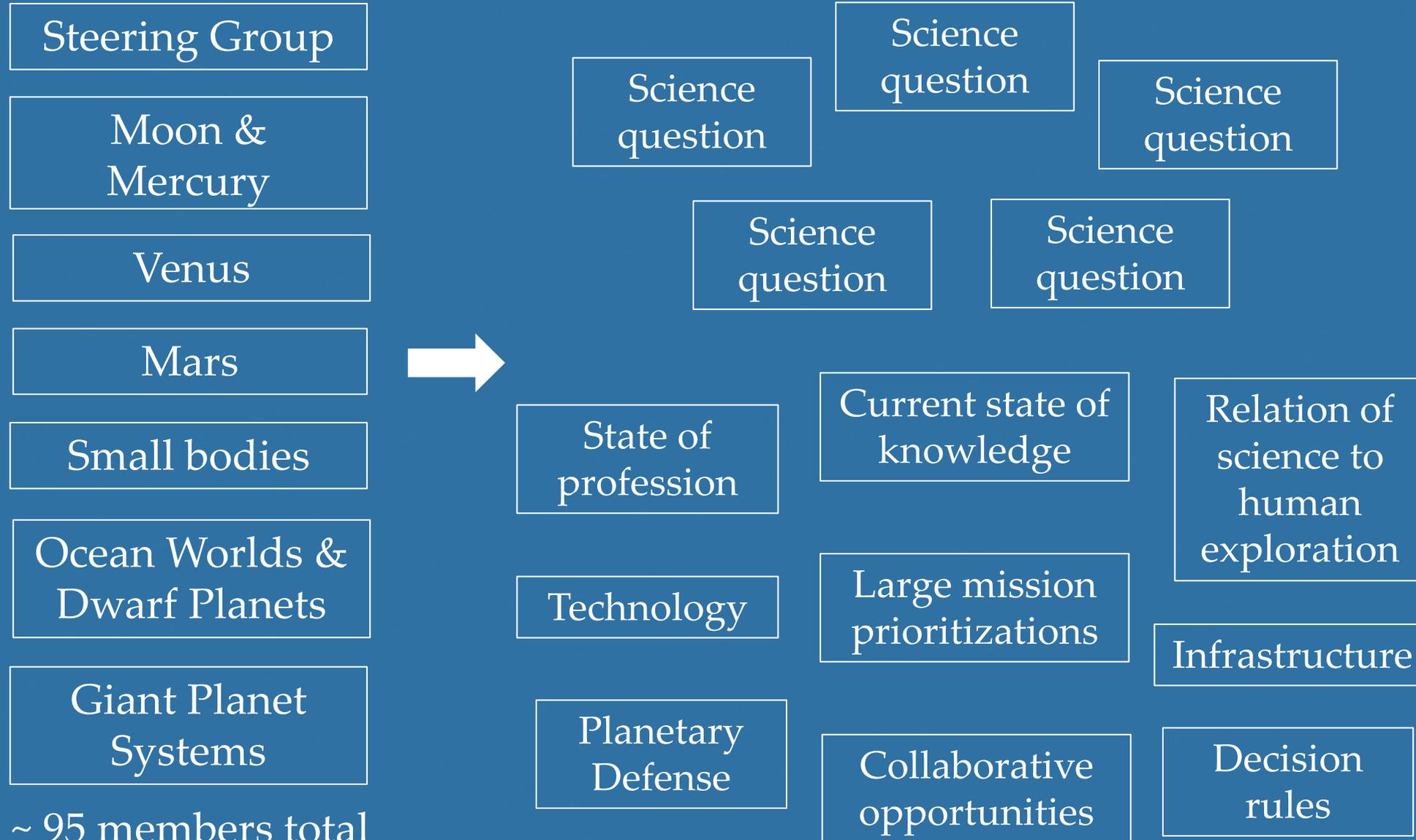


Survey Report

- Will be organized thematically, rather than by destinations as has been the case in prior Planetary Decadal reports
- Report chapters will be organized around cross-cutting science questions and other topics as needed to address the Statement of Task.
- Each chapter will have an associated working group, with members drawn from across the panels and steering group



Report Organized by Science Questions and Key Topics



- Cross-cutting science questions and recommended research activities
- Additional topics needed to address statement of task
- Each question/topic to be addressed by panel and SG members with related expertise



Decadal Process: Sept. 2020 → March 2022

1. Solicit community whitepapers → MORE THAN 500 RECEIVED ✓
2. Determine cross-cutting themes/priority topical questions ✓
3. Identify additional mission studies that are needed and complete studies ✓
4. Assess how progress will be made in next decade to address priority science questions and additional specific topics in statement of task. Commence drafting report.
5. Assess all mission studies to determine those best able to address cross-cutting themes/priority questions
6. Most promising concepts assessed for cost and technical realism by independent contractor
7. Prioritize missions and overall recommendations.
8. Report external review, respond to reviewer comments, final report approval
9. Release report to NASA, NSF, and public spring 2022



Example Exoplanet Topics in White Papers

- Studies of interior-surface-atmosphere interactions on Venus and Mars as analogs for understanding divergent tectonic and climate evolutionary paths of terrestrial-like exoplanets
- Studies of our gas/ice giants to provide ground-truth understanding on their origin, structure, and evolution as an analog for exoplanets with H atmospheres
- Synergies between Solar System and exoplanet life detection efforts, e.g., via study of terrestrial extremophiles
- Better observations of Earth and other SS bodies to inform strategies to remotely detect liquid surface water and/or extant life on exoplanets
- Impact of stellar activity and space weather on habitability of early Earth and exo-Earth environments
- Factors that affected evolution of Earth's prebiotic chemistry and possible alternative paths
- Detection of exoplanet magnetospheres from lunar farside
- **Improving cross-communication and collaboration between astronomy and planetary science communities**
“parallel communities, worlds apart”

All white papers available at:

<https://www.nas.edu/planetarydecadal>



Thank You

<https://www.nas.edu/planetarydecadal>



Survey Composition and DEIA

1) Demographics of ~ 95 Survey committee members:

27% early-career, 41% female, 16% minority, 50% Academic, 28% Other (JPL, Non-academic), 15% Government, 7% Private

2) State of Profession working group co-leads: Mahzarin Banaji and Orlando Figueroa

Membership from across panels and steering group; will address DEIA issues and policies/practices to improve the state of our profession.

Tremendous enthusiasm and many white papers received on these topics.

