The National Academies of
SCIENCES • ENGINEERING • MEDICINE

DIVISION ON ENGINEERING AND PHYSICAL SCIENCES
SPACE STUDIES BOARD

Steering Committee for A Science Strategy for the Human Exploration of Mars
Meeting No. 1
April 25-26, 2024

Hybrid Meeting
ALL TIMES IN US EASTERN STANDARD TIME (UTC-4:00)
Keck Center
500 Fifth St., N.W.
Washington, DC 20001

AGENDA

THURSDAY, APRIL 25, 2024

ROOM 106

OPEN SESSION

Livestream Link: https://vimeo.com/event/4241675

11:00 AM	**Presentation: High-level briefing from the source of the study*** *(45-minute presentation)*	**Dr. Debra Needham** **Program Scientist,** **Exploration Science Strategy and Integration Office, NASA** **Ms. Michelle Rucker** **Lead, Mars Architecture Team, Architecture Development Office** **Exploration Systems Development Mission Directorate, NASA**
11:45 AM	**Discussion: High-level briefing from the source of the study*** *(45-minute discussion)*	**Dr. Debra Needham** **Program Scientist,** **Exploration Science Strategy and Integration Office, NASA** **Ms. Michelle Rucker** **Lead, Mars Architecture Team, Architecture Development Office** **Exploration Systems Development Mission Directorate, NASA**
12:30 PM	*Working Lunch (60 minutes)*	
1:30 PM	**Presentation: Mars Exploration Program*** *(45-minute presentation)*	**Dr. Becky McCauley-Rench** **Program Scientist,** **Planetary Science Division, NASA**
2:15 PM	**Discussion: Mars Exploration Program*** *(30-minute discussion)*	**Dr. Becky McCauley-Rench** **Program Scientist,** **Planetary Science Division, NASA**
2:45 PM	Break (20 minutes)	

3:05 PM	**Presentation: Human research program*** *(45-minute presentation)*	**Mr. David Baumann** **Human Research Program Director,** **Space Operations Mission Directorate, NASA**
3:50 PM	**Discussion: Human research program*** *(30-minute discussion)*	**Mr. David Baumann** **Human Research Program Director,** **Space Operations Mission Directorate, NASA**
4:20 PM	Committee Adjourns to Closed Session (20 min break)	

FRIDAY, APRIL 26, 2024

ROOM 101

OPEN SESSION

Livestream Link: https://vimeo.com/event/4241681

9:00 AM **Presentation: NASA's Moon to Mars program overview*** — **Ms. Nujoud Merancy**
(20-minute presentation and 10-minute discussion)
Deputy Associate Administrator,
Strategy and Architecture Office,
Exploration Systems Development Mission Directorate, NASA

9:30 AM **Presentation: Decadal Survey on Biological and Physical Sciences Research in Space*** — **Dr. Robert Ferl**
(20-minute presentation)
Professor, University of Florida
Dr. Krystyn Van Vliet
Professor, Massachusetts Institute of Technology

9:50 AM **Discussion: Decadal Survey on Biological and Physical Sciences Research in Space*** — **Dr. Robert Ferl**
(20-minute discussion)
Professor, University of Florida
Dr. Krystyn Van Vliet
Professor, Massachusetts Institute of Technology

10:10 AM Break (20 minutes)

10:30 AM **Presentation: Planetary Science and Astrobiology Decadal Survey*** — **Dr. Philip Christensen**
(30-minute presentation)
Professor, Arizona State University

11:00 AM **Discussion: Planetary Science and Astrobiology Decadal Survey*** — **Dr. Philip Christensen**
(30-minute discussion)
Professor, Arizona State University

11:30 AM Break (20 minutes)

11:50 AM **Presentation: Decadal Survey for Solar and Space Physics (Heliophysics)*** — **Dr. Daniel Baker**
(10-minute presentation)
Director of LASP
University of Colorado Boulder

11:50 AM **Presentation: Decadal Survey for Solar and Space Physics (Heliophysics)*** — **Dr. Don Hassler**
(10-minute presentation)
Science Program Director
Instrumentation and Space Research Division
Southwest Research Institute

12:10 PM **Discussion: Decadal Survey for Solar and Space Physics (Heliophysics)*** — **Dr. Daniel Baker**
(15-minute discussion)
Director of LASP
University of Colorado Boulder
Dr. Don Hassler
Science Program Director
Instrumentation and Space Research Division
Southwest Research Institute

12:25 PM *Working Lunch (45 minutes)*

1:10 PM **Presentation: MEPAG Tiger team report*** — **Dr. Bruce Jakosky**
(45-minute presentation)
Senior Scientist & Professor Emeritus
University of Colorado Boulder

1:55 PM	**Discussion: MEPAG Tiger team report*** *(30-minute discussion)*	**Dr. Bruce Jakosky** **Senior Scientist & Professor Emeritus** **University of Colorado Boulder**
2:25 PM	Committee Adjourns to Closed Session (20 min break)	

The following information is provided for any members of the general public who may be in attendance:

This meeting is being held to gather information to help the committee conduct its study. This committee will examine the information and material obtained during this, and other public meetings, in an effort to inform its work. Although opinions may be stated and lively discussion may ensue, no conclusions are being drawn at this time and no recommendations will be made. In fact, the committee will deliberate thoroughly before writing its draft report. Moreover, once the draft report is written, it must go through a rigorous review by experts who are anonymous to the committee, and the committee then must respond to this review with appropriate revisions that adequately satisfy the Academy's Report Review committee and the chair of the NRC before it is considered an NRC report. Therefore, observers who draw conclusions about the committee's work based on today's discussions will be doing so prematurely.

Furthermore, individual committee members often engage in discussion and questioning for the specific purpose of probing an issue and sharpening an argument. The comments of any given committee member may not necessarily reflect the position he or she may actually hold on the subject under discussion, to say nothing of that person's future position as it may evolve in the course of the project. Any inference about an individual's position regarding findings or recommendations in the final report are therefore also premature.

STATEMENT OF TASK

The National Academies of Sciences, Engineering, and Medicine will convene an ad hoc committee to address the topic of "High Priority Science Campaigns for Human Explorers on the Surface of Mars." To address this topic, the committee will:

- Identify the highest priority science objectives among all relevant science disciplines to be addressed by humans on the surface of Mars. A separate follow-on study will investigate what science objectives are highest priority for in-space phases of crewed missions to Mars.
  a) Specify how each identified science objective maps to the respective decadal report or discipline roadmap as well as to one or more of the objectives identified in NASA's *Moon to Mars Objectives*.
  b) Identify any objectives missing in NASA's *Moon to Mars Objectives* that are relevant to this objectives mapping task.
  c) Explain how the objectives change or the priority order is altered by the number of crew or the duration of the surface mission. This includes noting if crew size or surface duration are factors for prioritization.

- Identify types of samples and measurements needed to address science objectives.
  a) Specify key measurements, if any, that need to be made before human arrival using preplaced assets, either in orbit or on the surface.
  b) Specify key measurements, if any, that must be made in situ or on the martian surface before return needed to achieve the identified science objectives. Justify why the measurements need to be made on the martian surface rather than in terrestrial laboratories.
  c) Specify key measurements, if any, that must be made in terrestrial labs on returned samples to achieve the identified science objectives. Include estimates of mass of returned sample(s) required to make identified measurements, and justify why the measurements need to be made in terrestrial laboratories rather than on the martian surface.
  d) Specify whether analyses of any surface-collected samples are needed to be performed during the return trip, and justify why measurements must be made in transit rather than on the Martian surface or in terrestrial laboratories.

- Identify and prioritize several science campaigns that would achieve a subset of the identified highest priority science objectives, where each campaign encompasses the first three landings of human-scale landers on Mars.
  a) For each science campaign, describe a science "roadmap" that includes the highest priority science objective(s) addressed, secondary science objectives that are also achievable, measurements needed to address the objectives, and key assets and major equipment emplaced at each phase of the campaign (before, during, between, or after crew missions).
  b) Include a discussion of the crew's role in achieving the science objectives.

c) If applicable, specify, and justify any variations in the provided guidance for campaigns needed to achieve the highest priority science objectives (for example, more than three missions).

- For the highest priority science campaigns, identify preliminary criteria for appropriate landing sites, based on available data, that will enable science objectives to be met. Examples of criteria that might be considered include: 1) ice within a certain surface depth, 2) salt-bearing materials accessible to crew, or 3) caves with accessible entrance points for human explorers. Discussion of specific landing sites is not requested.

- Identify any key equipment needed for each science campaign to address the identified science objectives.

- Include a discussion of the criteria used to assign prioritization for science campaigns.

- Describe commonalities with Moon exploration. For example, discuss equipment and capabilities for each campaign that could also be developed and used for upcoming human exploration missions to the Moon, Gateway, or the International Space Station (ISS). If relevant and straightforward, note any equipment/capabilities developed for the Moon, Gateway, or ISS is relevant to Mars exploration.

- Identify key synergies with exploration goals. Specifically, discuss how science activities in each campaign synergize with NASA's Moon to Mars Strategy and Objectives Development report.