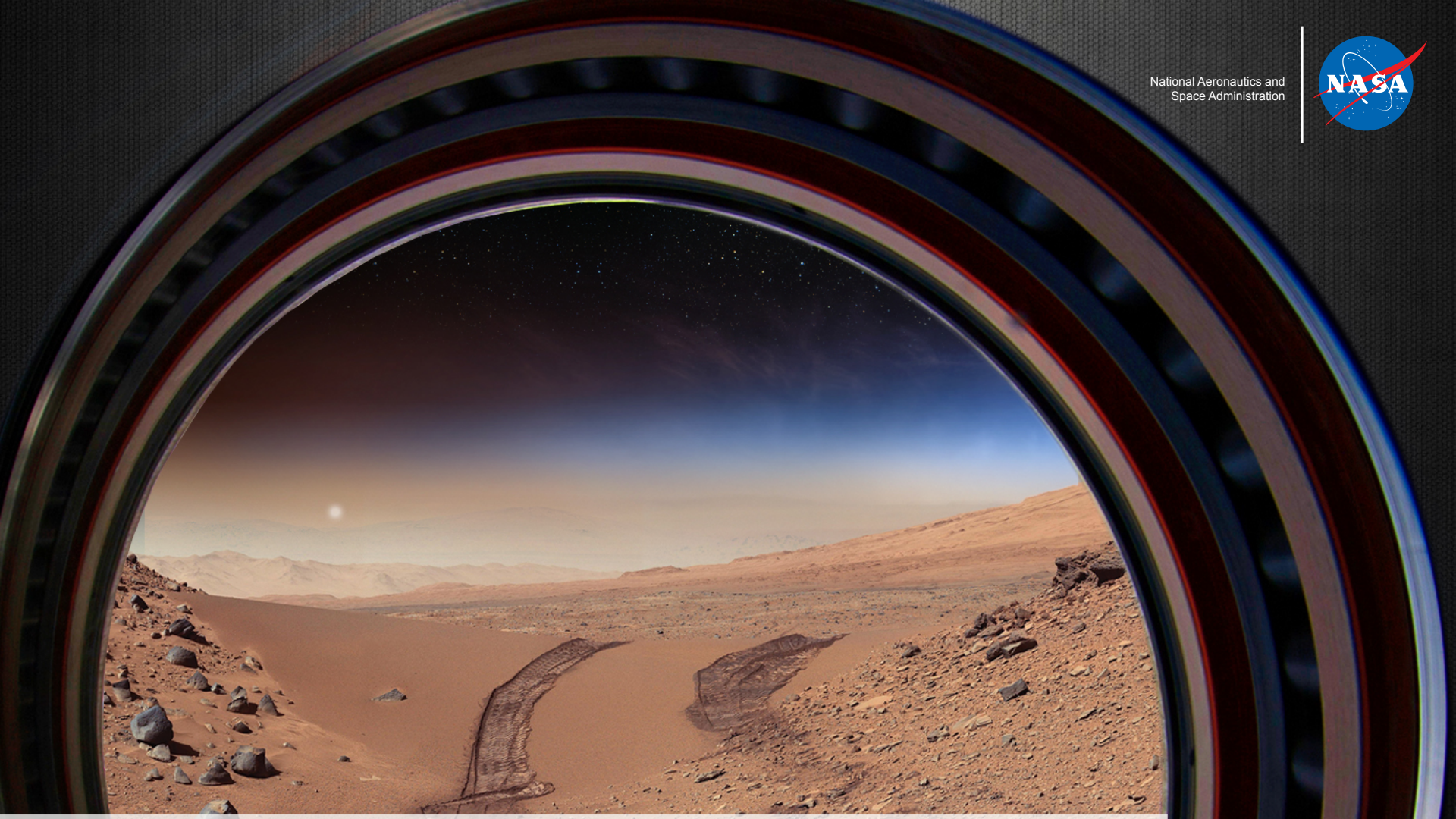
National Aeronautics and Space Administration



Research Subcommittee Report

Briefing to the HEO Advisory Committee July 25, 2016

David E. Longnecker, MD, Research Subcommittee Chair

Research Subcommittee Mission

From the Research Subcommittee Terms of Reference:

The Research Subcommittee is established to review and assess NASA's approach to research in support of human exploration. The Subcommittee will specifically review and assess NASA's approach, progress, and plans for developing strategies and capabilities that reduce technical barriers to future exploration missions and strengthen national research participation in human space exploration.

The Research Subcommittee will support the HEO Committee in its missions by meeting the following objectives:

1. **Provide advice and recommendations on the overall objectives, approach, content, and structure of research activities in HEOMD.**

2. **Provide assessments on the effectiveness of relationships between HEOMD's missions and stakeholders in the research and educational sectors.**

Current Research Subcommittee Members

Bob Altenkirch

President, UAH

PI for the Solid Surface Combustion Experiment and the Diffusive and Radiative Transport in Fires Experiment

Kathy Banks

Vice Chancellor and Dean of Engineering, Texas A&M

Jeff Hoffman

Professor of the Practice, Department of Aeronautics and Astronautics, MIT

Mission Specialist, STS 51-D, 35, 46, 61, 75

Stein Sture

Professor of Civil Engineering, former Vice Chancellor for Academic Affairs, University of Colorado

PI for the Mechanics of Granular Materials Experiment

Jim Pawelczyk

Associate Professor of Physiology and Kinesiology, Penn State

Payload Specialist, STS-90

Kathy Thornton

Professor of Mechanical and Aerospace Engineering, University of Virginia

Mission Specialist, STS-33, 49, 61, 73

David E. Longnecker (Subcommittee Chair)

Professor and Chair Emeritus, Department of Anesthesiology and Critical Care

University of Pennsylvania

Recent Research Subcommittee Agendas

March 7, 2016 – Research Beyond ISS

NASA Status	Porterfield
From ISS to Cis-Lunar Space	Scimemi
Evolvable Mars	Moore
Life Sciences Beyond ISS	Kundrot
Physical and Engineering Sciences Beyond ISS	Carpenter
Discussion w/HEOMD AA	Gerstenmaier

July 20, 2015 – SLPSRAD Research Plan

NASA Status	Porterfield
Physical Sciences	Lee
	Chiaramonte
Space Biology	Tomko
Human Research	Davison

Examples: Human Health Challenges for Exploration Missions

IN-FLIGHT

- On-board medical treatment (equipment, medications and expertise)
- Visual and intracranial abnormalities (VIIP)
- Diet/nutritional consequences of long-term food storage
- Muscle & bone loss
- Renal stones (nephrolithiasis)
- Behavioral health and performance

- **POST-FLIGHT**
- Persistent visual abnormalities
- Chronic nephrolithiasis
- Persistent bone loss/accelerated osteoporosis
- Long-term consequences of space radiation

Potential Issues for Future Meetings

- Simulating Long-duration Exposure to Partial Gravity. - We are unlikely to have comprehensive data on long-duration human exposure to reduced gravity prior to undertaking a ~1000 day Mars mission. There are no facilities or models to study the consequences of long-term partial gravity on the human body, either for countermeasure development or estimation of human performance on planetary surface operations (e.g, 1/6 or 3/8 G). Are there animal models that could effectively address questions of human health and performance in extended partial gravity?

- Cis-Lunar Missions. What activities require human presence in the cis-lunar environment prior to a Mars mission? If required, what are the opportunities for evaluation of human performance and/or countermeasure development?

Potential Issues for Future Meetings, continued

•**Research that enables Technology Development. NASA is making a substantial investment in basic microgravity research in areas like fluid mechanics, soil mechanics and combustion phenomena and the resulting knowledge is often sought by the academic community. How can NASA best link this knowledge and expertise into the development of space technologies for exploration class missions?**

•**Relationships that enable Research. SLPS is necessarily focused on space biology and physical sciences that respond to mission needs or proposals from the scientific community. Is the portfolio of the program appropriately balanced and are there opportunities to leverage new linkages with other federal, academic or commercial entities that will lead to the next generation of space research?**