# Key Non-Polar Destinations Across the Moon to Address Decadal-level Science Objectives with Human Explorers: Panel on Lunar and Planetary Sciences

## Committee

## Alexander J. Evans

**Chair**

ALEXANDER J. EVANS is the Thomas J. and Alice M. Tisch Assistant Professor of Earth, Environmental, and Planetary Sciences at Brown University. Research interests include understanding the evolutionary, tectonic, geodynamic, and geophysical processes of solid planets. Evan's work includes analyses of altimetry, gravity, geomorphology, and tectonics to determine the structure, surface, and internal evolution of solid planets. Prior to joining Brown University, Evans held postdoctoral research positions at the Lunar and Planetary Laboratory at the University of Arizona, the Southwest Research Institute, the Colorado School of Mines, and Columbia University. Evans is the recipient of numerous awards including the National Association of Graduate-Professional Students' Lifetime Achievement Award and the Massachusetts Institute of Technology's Presidential Fellow Award. Evans holds a Ph.D. in planetary geophysics from the Massachusetts Institute of Technology.

## Carolyn A. Crow

**Member**

CAROLYN A. CROW is an assistant professor in the Department of Geological Sciences at the University of Colorado (UC), Boulder. Prior to UC Boulder, Crow was a postdoctoral researcher at Lawrence Livermore National Laboratory. Crow's research focuses on understanding the evolution of planetary crusts through geochemical analyses of samples. Crow has worked with samples ranging from lunar rocks returned by Apollo astronauts, martian meteorites, and samples from the Vredefort impact basin in South Africa. Crow's research also supports nuclear forensics projects that aim to understand the signatures of underground nuclear explosions in support of the Comprehensive Test Ban Treaty. Crow holds a Ph.D. in geochemistry from the University of California, Los Angeles.

## Timothy Glotch

**Member**

TIMOTHY GLOTCH is a professor of geosciences at Stony Brook University. Glotch's research interests include (1) laboratory spectroscopic measurements of minerals, extraterrestrial samples and their analogs under appropriate environmental conditions (i.e, simulated lunar or asteroid environments), (2) micro-Raman and nano-infrared spectroscopy of terrestrial and extraterrestrial samples, (3) development of light scattering models for analysis of planetary regolith, and (4) quantitative remote sensing at infrared wavelengths of the surfaces of Mars, the Moon, and small bodies. Glotch is the principal investigator of the Remote, In Situ, and Synchrotron Studies for Science and Exploration 2 (RISE2) node of NASA's Solar System Exploration Research Virtual Institute. RISE2 is composed of over 50 researchers and students utilizing state of the art laboratory, theory, and field techniques to further NASA's science and human exploration goals at the Moon, near Earth asteroids, and the Moons of Mars. Glotch holds a Ph.D. in geological sciences from Arizona State University.

## James T. Keane

**Member**

JAMES TUTTLE KEANE is a scientist at the Jet Propulsion Laboratory (JPL). Keane’s research focuses on studying the interactions between orbital dynamics, rotational dynamics, and geologic processes on rocky and icy worlds across the solar system. Prior to joining JPL, Keane was a postdoctoral fellow in the Joint Center for Planetary Astronomy under the Division of Geological and Planetary Sciences at the California Institute of Technology, and a graduate research associate at the University of Arizona. Keane has extensive experience with NASA missions, including the GRAIL lunar orbiter and the New Horizons mission to Pluto and the Kuiper belt. Keane is currently an affiliate of the Keck Institute for Space Studies, a journeyman for the International Association of Astronomical Artists, and a member of the American Geophysical Union, the American Astronomical Society, the AAS Division of Dynamical Astronomy, and the AAS Division for Planetary Science. Keane is the recipient of numerous awards including the Editor’s Citation for Excellence in Refereeing Award from Geophysical Research Letters and the Pellas-Ryder Award of the Geological Society of America. Keane holds a Ph.D. in planetary science from the University of Arizona.

## Thomas S. Kruijer

**Member**

THOMAS S. KRUIJER is a staff scientist in the Cosmochemical and Isotopic Signatures Group at Lawrence Livermore National Laboratory. Kruijer's research is focused on determining the origin, accretion, and early evolution of protoplanets, the terrestrial planets and the Moon, as well as on addressing problems in nuclear forensics. This is accomplished by reconstructing processes and events using isotopic signatures and chronometric tools. To this end, Kruijer measures small-scale isotopic variations in meteorites, lunar rocks, and anthropogenic samples, by utilizing novel and precise isotope ratio mass spectrometry techniques. Kruijer received the 2019 F.W. Clarke Award from the Geochemical Society for his analysis of timescales and planetary accretion and the 2020 Nier Prize in Meteoritics. Kruijer received his PhD from ETH Zürich, Switzerland, specializing in isotope geo- and cosmochemistry.

## William B. McKinnon

**Member**

WILLIAM B. MCKINNON is a professor of Earth and planetary sciences at Washington University in Saint Louis. He also serves as a fellow of the McDonnell Center for the Space Sciences. McKinnon’s research interests include the structure, origin, evolution, geology, and bombardment history of outer planet satellites and dwarf planets; and impact mechanics on rocky and icy bodies. McKinnon is a Co-investigator for both NASA’s Europa Clipper and ESA’s Jupiter Icy Moons Explorer (JUICE) missions, and an Emeritus science team member of NASA’s New Horizons mission to Pluto and the Kuiper belt. In 2014 he received the G.K. Gilbert Award from the Planetary Geology Division of the Geological Society of America and in 2023 the Kuiper Prize of the Division for Planetary Sciences of the American Astronomical Society. McKinnon holds a Ph.D. in planetary science and geophysics from the California Institute of Technology. McKinnon has served as a member of the National Academies Committee on Astrobiology and Planetary Science (co-chair from 2017-2021), the Steering Committee of the Planetary Science and Astrobiology Decadal Survey 2023-2032, the Committee on Planetary and Lunar Exploration, and the Committee on Priorities for Space Science Enabled by Nuclear Power and Propulsion: A Vision for Beyond 2015. He was elected to the National Academy of Sciences in 2023.

## David W. Reed

**Member**

DAVID W. REED currently manages and provides technical direction for Redwire's Mission Integration and Operations department as the director of Spaceport Operations adjacent to NASA Kennedy Space Center. Reed has been involved in the solicitation, design, development, operation, and program management of human spaceflight payloads for over 33 years including physical sciences and biology payloads aboard Spacelab, Space Shuttle, and the International Space Station. Reed has supported several NASA process improvement teams and is considered a subject matter expert in both space biology and NASA's payload safety process. Reed's honors include NASA's Spaceflight Awareness Silver Snoopy and Launch Honoree Awards, three NASA Group Achievement Awards, a Kennedy Space Center Silver Dollar Award, several Certificates of Appreciation for significant contributions to spaceflight payloads, and a commendation for STS-107 contingency response. Reed is a member of the American Society for Gravitational and Space Biology and the American Astronautical Society. Reed holds an M.S. in chemical engineering from the University of Virginia.

## Sarah Valencia

**Member**

SARAH VALENCIA is a lunar petrologist with the University of Maryland College Park. Valencia's work focuses on the evolution of igneous systems on the Moon, in particular, Moon rocks with unusual compositions. Valencia studies rocks from the Moon – both from the Apollo sample collection and lunar meteorites. Valencia studies fragments of lunar granite and rocks associated with granite to understand the chemistry of these rocks, how they are related, and how they might have formed. Valencia also uses data gathered by Lunar Reconnaissance Orbiter (LRO) to study the evolution of lunar rocks on the surface of the Moon. Valencia holds a Ph.D. in Earth and planetary sciences from Washington University of St. Louis.