A Science Strategy for the Human Exploration of Mars: Panel on Geosciences

Committee

Jennifer L. Heldmann

Chair

Jennifer L. Heldmann is a research scientist at NASA Ames Research Center. Heldmann’s research interests focus on the studies of the Moon and Mars, including improving our understanding of lunar volatile deposits and studies of recent water on Mars through analysis of spacecraft data, numerical modeling, and terrestrial analog fieldwork. Heldmann is the principal investigator (PI) of the Field Investigations to Enable Solar System Science and Exploration (FINESSE) and Resource Exploration and Science of OUR Cosmic Environment projects. She has served as the Planetary Science Division Lead for NASA’s Optimizing Science & Exploration Working Group (OSEWG) and has served on multiple MEPAG (Mars Exploration Program Analysis Group) committees focused on science and human exploration including the MEPAG Human Mars Missions Science Objectives Tiger Team (HMMSOTT, 2023). She is a member of the NASA VIPER (Volatiles Investigating Polar Exploration Rover) lunar mission team and serves multiple roles within NASA’s Artemis human exploration program including as a member of the Artemis III Science Definition Team, the Artemis III Geology Team, and as the Lead for lunar volatiles in Artemis astronaut crew training. She served as Co-Lead of the HExWG (Human Exploration Working Group) for the National Academies Planetary Science and Astrobiology Decadal Survey 2023-2032. Heldmann is the recipient of numerous awards, including the NASA Exceptional Scientific Achievement Medal, NASA Exceptional Service Medal, NASA Coradini Award for Exploration, multiple NASA Group Achievement Awards including the FINESSE and Mojave Volatile Prospector projects as PI, and a NASA Superior Achievement Award for Science. Heldmann has also been awarded the Association of Women Geoscientists Professional Excellence Award and a U.S. Antarctic Program Service Medal. She is a member of the Space Camp Hall of Fame at the U.S. Space & Rocket Center in Huntsville, AL. Heldmann received a Ph.D. in planetary science from the University of Colorado, Boulder.

William B. Banerdt

Member

William B. Banerdt is currently retired. Banerdt previously worked as a planetary geophysicist at the Jet Propulsion Laboratory of the California Institute of Technology for more than 45 years and twice held a position of Professeur Invité at the Instut de Physique du Globe de Paris. Banerdt has worked on numerous planetary exploration missions, including Magellan, Mars Global Surveyor, and the Mars Exploration Rovers (for which Banerdt served as project scientist for six years). Banerdt was the principal investigator of the InSight Mission until its end in 2022. Banerdt is the recipient of fifteen NASA Group Achievement Awards, the NASA Outstanding Public Leadership Medal in 2019, and the AAAS Newcomb Cleveland Prize in 2022. Banerdt received a Ph.D. in geological sciences from the University of Southern California.

Ali M. Bramson

Member

Ali Bramson is an assistant professor at Purdue in the Department of Earth, Atmospheric, and Planetary Sciences. Bramson's research expertise is on the processes that affect the surfaces of planets in our Solar System, including those related to ice and volatiles. Bramson's work is helping shape the future of in situ resource utilization and human exploration of Mars, as well as plan future robotic spacecraft missions for planetary science. Bramson is a member of the American Geophysical Union and the Division of Planetary Sciences of the American Astronomical Society, and has won numerous awards, including the Ralph E. Powe Junior Faculty Enhancement Award from Oak Ridge Associated Universities and the Lunar and Planetary Institute Career Development Award. Bramson received a Ph.D. in planetary sciences with a minor in geosciences from the University of Arizona.

Veronica Bray-Durfey

Member

Veronica Bray-Durfey is associate research professor and science operations engineer for the Mars Reconnaissance Orbiter's HiRISE instrument at the Lunar and Planetary Laboratory of the University of Arizona. Bray is a geologically trained planetary scientist whose research focuses on impact crater formation across the solar system, utilizing a combination of spacecraft observations, terrestrial field studies, and computer modelling. Since 2013 Bray has also been a targeting specialist for the HiRISE camera onboard the Mars Reconnaissance Orbiter, using the spacecraft to return new images of Mars. As a team member of Cassini, MRO, LRO, and New Horizons, Bray has become familiar with the surface and subsurface properties of various planetary bodies and has received multiple science and operation awards from NASA. Since 2016, Bray has been combining science and mission operations experience to develop mission concept of operations and terrestrial analogue testing plans for seismometer development. Bray's work has included a variety of human and robotic lander targets, including the Moon, Mars, asteroids, and the icy satellites. Bray received a Ph.D. in planetary science from the Imperial College, London.

Alexander N. Halliday

Member

Alex Halliday (NAS) is a professor at Columbia University and a geochemist who was previously director of the Earth Institute and founding dean of the new Columbia Climate School (until 2023). Prior to that Halliday was dean of science and engineering and then vice president of the Royal Society while at Oxford University. Halliday is best known for the development of multiple-collector inductively-coupled plasma mass spectrometry and its application to the timing and processes of accretion, core formation and volatile loss in the terrestrial planets. He is the former president of the Geochemical Society, the European Association of Geochemistry, and the Volcanology, Geochemistry and Petrology Section of the American Geophysical Union. He is a fellow of the Royal Society, an international member of the U.S. National Academy of Sciences, and the recipient of the Murchison Medal of the Geological Society, the Urey Medal of the European Association of Geochemistry, the Oxburgh Medal of the Institute of Measurement and Control, the Bowen Award and Harry H. Hess Medal of AGU, and a Knighthood for services to science and innovation. Halliday received a Ph.D. in geophysics from Newcastle University.

Jeffrey R. Johnson

Member

Jeffrey Roy Johnson is a principal professional staff member at the Johns Hopkins University’s Applied Physics Laboratory. Johnson was the director at the United States Geological Survey Astrogeology Science Center in Flagstaff, AZ. Johnson is a planetary scientist who uses spacecraft and laboratory spectroscopic data to understand the composition and light scattering properties of planetary surfaces. Johnson was a participating scientist on the Mars Polar Lander and Mars Exploration Rover (MER) missions, served as an associate principal investigator on MER, and is currently a participating scientist on Mars Science Laboratory (MSL) Curiosity, a co-investigator on the SuperCam and Mastcam-Z instruments on Mars2020 Perseverance, and co-investigator on the Dragonfly mission. Johnson served as chair of the Mars Exploration Program Analysis Group (MEPAG) from 2016-2019 and a member of the Planetary Science Subcommittee of the NASA Advisory Council (2008-2012, 2016). Johnson received NASA Group Achievement Awards for the Mars Pathfinder, MER, MSL, and Mars2020 missions. Johnson received a Ph.D. in geosciences from the University of Arizona.

John F. Mustard

Member

John F. Mustard is a professor in the Department of Earth, Environmental and Planetary Sciences and co-director of the Earth 4D program of the Canadian Institute for Advanced Research at Brown University. Mustard explores the Earth and planets to understand how they operate and evolve using advanced satellite technologies and is particularly interested in the prospects for life off the Earth. The Canadian Institute For Advanced Research Earth 4D program studies Earth's rich subsurface biosphere to consider the prospects for underground habitability for planets. Mustard is the lead of the International Space Science Institute (ISSI) working group "Extant Subsurface Life on Mars? Science, Tools & Missions Together," Mustard has also been involved in the exploration of Moon and Mars since 1989 on NASA, European and Indian spacecraft, including as the deputy principal investigator of the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) on NASA's Mars Reconnaissance Orbiter, co-investigator on the OMEGA experiment on European Space Agency's Mars Express and NASA's Moon Mineralogy Mapper instrument that flew on India's Chandrayaan Spacecraft. Mustard chaired the Mars 2020 Science Definition Team in 2014 and was the chair of the Mars Exploration Payload Assessment Group (MEPAG) 2007-2010. Mustard is a fellow of the American Association for the Advancement of Science and American Geophysical Union, and was awarded the NASA Medal for Exceptional Public Service. Mustard has authored over 200 refereed articles and received a Ph.D. in geological sciences from Brown University.

Chiang Shih

Member

Chiang Shih is a professor in the Department of Mechanical Engineering, FAMU-FSU College of Engineering (COE) which is affiliated jointly with Florida State University and Florida A&M University, and director, Aero-propulsion, Mechatronics, and Energy (AME) Center. Shih previously served as chair of the Department of Mechanical Engineering, FAMU-FSU COE. Shih was responsible for the coordination, design, and establishment of the Aero-propulsion, Mechatronics, and Energy (AME) Center, a multidisciplinary research center, while serving as the director since the center's inauguration in 2012. Shih's research interests are in the areas of unsteady aerodynamics, separated flow control, aero-acoustics, high speed flow control, and optical diagnostic techniques. In recent years, Shih has focused on the broadening participation of engineers through professional training and workforce development activities. Shih has led several integrated research and education programs supported by NASA, NSF, and DOD. Shih plays a critical role in the ongoing development of the aerospace engineering graduate degree program for COE. Shih is an American Society of Mechanical Engineers fellow and an American Institute of Aeronautics and Astronautics associate fellow. Shih received a Ph.D. in aerospace engineering from the University of Southern California.

Kirsten Siebach

Member

Kirsten Leigh Siebach is an assistant professor at Rice University. Siebach's work focuses on understanding sedimentary processes on Mars and early Earth through analysis of sedimentary rock textures, chemistry, and mineralogy. Siebach is also actively engaged in promoting education and outreach related to Earth and planetary sciences. Siebach is a participating scientist on the Mars 2020 Perseverance mission, a member of the Science and Operations Team for the Mars Science Laboratory and previously worked on the operations teams for the Phoenix Lander and Mars Exploration Rovers. Siebach has received several NASA Group Achievement Awards for work on the Mars Science Laboratory, Mars Exploration Rovers, and Phoenix missions and the Harrison Schmitt Award from the American Association of Petroleum Geosciences. Prior to joining Rice University, Siebach was a postdoctoral research associate at Stony Brook University studying the geochemistry of Martian sediments and received a Ph.D. in geology from the California Institute of Technology.

Marcella A. Yant

Member

Marcella Aveline Yant is a planetary research scientist at Lockheed Martin, supporting Deep Space Exploration and the Advanced Technology Center. Yant bridges the gap between science and engineering by integrating technology with mission objectives. Yant is an early career scientist with a background in multiple disciplines including geology, biology, chemistry, and mission formulation. Yant's expertise is in geological and surface properties on Mars, focusing on near/infrared spectroscopy (experimental work, remote-sensing, and field analogs) and the integration of handheld instruments for field geology and human exploration. Yant was previously a postdoctoral fellow at Johns Hopkins University working with the NASA SSERVI team, Project ESPRESSO and received a Ph.D. in geosciences from Stony Brook University.