

A Science Strategy for the Human Exploration of Mars: Panel on Atmospheric Science and Space Physics

Committee

Leslie K. Tamppari

Chair

LESLIE K. TAMPPARI is a principal scientist at the Jet Propulsion Laboratory (JPL)/California Institute of Technology. Tamppari is the project scientist for the Mars Reconnaissance Orbiter and a collaborator (former co-investigator) on the Perseverance rover's Mars Environmental Dynamics Laboratory experiment. Tamppari was the project scientist for the Phoenix lander mission and was also associate directorate scientist for the Planetary Science Directorate at JPL. Tamppari studies water vapor, ice, and dust in the Martian atmosphere using orbital and landed data sets and has served on three previous NASA advisory committees. Tamppari has been awarded two NASA Exceptional Achievement Medals and numerous group achievement awards. Tamppari received a Ph.D. from the University of California, Los Angeles.

Yaireska M. Collado-Vega

Member

YAIRESKA COLLADO-VEGA is the Project Scientist for the Space Weather Next-L1 Series, at the NOAA/NASA Space Weather Observations Office at NOAA NESDIS. Collado-Vega was the founder and until February 2024, the director of the Moon to Mars Space Weather Analysis Office at NASA Goddard Space Flight Center, which conducts real-time space weather assessments to support the development and validation of new capabilities for understanding space weather impacts on NASA robotic missions and human exploration activities. Collado-Vega's research interest focuses on the solar wind interaction with the Earth's magnetic environment, solar energetic particle events and coronal mass ejections, X-ray imagers, and space weather effects on planetary environments. While at NASA, Collado-Vega worked and supported the initial collaborations of Mars missions with the M2M Office to understand space weather impacts on the Mars environment. Collado-Vega also works on the validation of magnetospheric models and the current developments on machine learning capabilities to improve space weather analysis and forecasting. She was also a Co-Investigator in several NASA internal funded proposals on a data mining tool development, has presented at many international and national scientific conferences, and was awarded several NASA Robert H. Goddard Awards on Mission and Enabling Support and Customer Service for her support of NASA missions. She conducts education and public outreach for NOAA NESDIS and also did it for many years for NASA and the Heliophysics Science Division including social media events and live tv/radio interviews in English and Spanish. She was part of NASA for 19 years, working on real time space weather analysis and mission support since 2012. Collado-Vega received a Ph.D. in space physics from The Catholic University of America.

Jasper S. Halekas

Member

JASPER S. HALEKAS is a professor in the Department of Physics and Astronomy at the University of Iowa. Halekas designs and builds instruments to measure charged particles in the solar wind and planetary environments, and utilizes these measurements to broaden understanding of the impact of the Sun and the solar wind on the solar system and its evolution. Halekas is a member of the MAVEN (instrument lead and co-investigator [co-I]), Lunar Vertex (deputy principal investigator), Parker Solar Probe (co-I), LuSEE (Co-I), HelioSwarm (instrument scientist), and TRACERS (instrument lead and co-I) mission teams. Halekas has been awarded NASA's Exceptional Scientific Achievement Award, multiple NASA team achievement awards, citations for excellence in refereeing, and the Collegiate Teaching Award and Collegiate Scholar Award from the University of Iowa. Halekas received a Ph.D. in physics from the University of California Berkeley.

Alain SJ. Khayat

Member

Alain SJ. Khayat is a research astrophysicist in planetary studies at the Planetary Systems Laboratory of NASA's Goddard Space Flight Center. His research primarily focuses on developing and applying multi-wavelength (submillimeter to ultraviolet) atmospheric radiative transfer models to interpret spectroscopic and imaging data from orbiting spacecrafts, rovers and Earth-based observatories to provide insights into understanding the composition and surface interactions, structure and evolution of the Martian atmosphere and its climate, in support of future human exploration of the red planet. He has led peer-reviewed, NASA grant-supported research of the atmosphere of Mars to collect and analyze data from the Mars Reconnaissance Orbiter (MRO), the Mars Science Laboratory (MSL) Curiosity rover, the ExoMars Trace Gas Orbiter (TGO), and the HOPE mission's Emirates Mars Infrared Spectrometer (EMIRS). Khayat is the recipient of numerous NASA research funding awards such as the Mars Data Analysis Program, and the Planetary Data Archiving, Restoration, and Tools. He has served on numerous review panels for NASA and the United Kingdom Space Agency. He received his Ph.D. in Astronomy from the Institute for Astronomy and the NASA Infrared Telescope Facility at the University of Hawai'i at Manoa. Khayat has not previously served on any National Academies committee.

Ralph D. Lorenz

Member

RALPH D. LORENZ is principal professional Staff, Space Exploration Sector, at the Johns Hopkins Applied Physics Laboratory. Lorenz is a planetary scientist with a particular interest in atmosphere/surface interactions and how planetary environments affect spacecraft and instruments. Before joining the Applied Physics Lab in 2006, Lorenz worked at the University of Arizona and the European Space Agency. Lorenz is the mission architect of the Dragonfly mission to Titan and leads the development of its meteorology/geophysics package; and the science lead for the Venus Atmospheric Structure Investigation on the DAVINCI probe. Lorenz has participated in previous NASA and international missions including Cassini/Huygens, Akatsuki, InSight and Perseverance, studying phenomena including lightning, dust devils, ocean waves, acoustics, and volcanism. Lorenz is the author of "Exploring Planetary Climate," "Space Systems Failures," "Dune Worlds," and seven other books. Lorenz is the recipient of the American Geophysical Union Whipple Award, the Hermann Oberth and Luigi Napolitano awards of the International Astronautical Federation, and eight NASA Group Achievement Awards. Lorenz received a Ph.D. in Space Sciences from the University of Kent at Canterbury in 1994 and served previously on the National Academies Committee on the Origins and Evolution of Life.

Sara Navarro López

Member

SARA NAVARRO LÓPEZ is a research engineer at the Advanced Instrumentation Space Exploration Group of the Centro de Astrobiología in Spain. The Centro de Astrobiología (CAB) is a joint research center of the Consejo Superior de Investigaciones Científicas (Spanish National Research Council) and the Instituto Nacional de Técnica Aeroespacial (National Institute of Aerospace Technology). Navarro López's research includes the application of Artificial Intelligence (AI) techniques for data exploitation of partially damaged sensors, or highly perturbed sensors. Navarro López is a co-investigator of the Mars Environmental Dynamics Analyzer team of the Mars2020 mission and a science team member of the Mars Science Laboratory (MSL) mission. Navarro López has been an active member on MSL and InSight Mars missions with the design, development and operation of the weather stations onboard the Mars rovers and lander platform. Navarro López's work has focused particularly on the development and exploitation of Mars wind sensor instruments; currently serving as the wind sensor instrument engineering lead for the Mars environmental stations REMS, APSS and MEDA. Navarro López received a masters degree in industrial engineering at the Universidad Politécnica de Madrid, Spain, specializing in robotics and electronics.

Claire E. Newman

Member

CLAIRE E. NEWMAN is a senior research scientist and vice president at Aeolis Research. Newman studies atmospheric and aeolian activity on present day Mars and Titan, via orbital and surface observations as well as numerical modeling. Newman is a member of the science teams of the Mars Science Laboratory Curiosity rover, InSight Mars lander, Mars 2020 Perseverance rover, and Dragonfly Titan rotorcraft mission. Newman is a member of the Mars Exploration Program Analysis Group (MEPAG) Goals Committee as co-lead for Goal II (climate), and was a member of MEPAG's Mars Concurrent Exploration Science Assessment Group and co-author of its final report. Newman is a recipient of several NASA Group Achievement Awards for work on Mars missions. Newman received a Ph.D. in Physics from the University of Oxford in 2001 and subsequently was an O.K. Earl Postdoctoral Scholar in geology at the California Institute of Technology. National Academies service includes the Mars panel for the 2023 Planetary Science and Astrobiology Decadal Survey.

Susanne P. Schwenger

Member

SUSANNE P. SCHWENZER is a Professor of Planetary Mineralogy in the School of Environment, Earth and Ecosystem Sciences at the Open University and associate director of AstrobiologyOU, a research center that spans several faculties and multiple schools. Prior to her appointment at the Open University Schwenger held post doctoral positions in Germany at Max Planck Institute and in the US at the Lunar and Planetary Institute. Schwenger's research focuses on Mars and the Earth, with expertise centering around: atmospheric exchange with the surface and subsurface of a planet, mainly through noble gas research, and water-rock reactions. Thus, volatiles and their sources, pathways and sinks are Schwenger's main area of expertise. Schwenger is currently working on the NASA Mars Science Laboratory Rover team contributing to the science and operations of that mission for over twelve years; and in the future will be taking part in the ESA ExoMars rover mission as an interdisciplinary scientist. Schwenger received a Ph.D. in planetary science from the University of Mainz, Germany.

Alejandro Soto

Member

ALEJANDRO SOTO is a lead scientist at the Southwest Research Institute, working in the Solar System Science & Exploration Division. Soto previously worked as an engineer at the Jet Propulsion Laboratory, working on advanced concept design, flight development, and science operations. Currently, Soto studies the climate dynamics of rocky-body atmospheres, using both global and mesoscale atmospheric models to understand atmospheric dynamics and the exchange of energy and material between the surface and atmosphere. Soto is also involved in instrument and mission development, with a particular focus on developing in situ instruments to characterize the atmospheric environment on Mars and elsewhere. Soto received a Ph.D. in planetary science from the California Institute of Technology.

Mark H. Thiemens

Member

MARK THIEMENS, NAS, is Distinguished Professor of Chemistry and Biochemistry and John Dove Isaacs Endowed Chair in Natural Philosophy for Physical Sciences at the University of California, San Diego. Thiemens' research is centered on the use of the mass-independent fractionation process for stable isotopes to study the origin and evolution of the solar system, the definition of the source and transformation of greenhouse gases in the troposphere, the chemistry of the stratosphere and mesosphere, the chemistry of the ancient Martian atmosphere, and the origin and evolution of oxygen-ozone and life in the Earth's Precambrian. Thiemens extensive National Academies service includes membership on the Board on Energy and Environmental Systems, Space Studies Board, PNAS Editorial Board, and the Committee on the Review of Planetary Protection Requirements for Mars Sample-Return Missions. He recently organized the Special Feature, "Water on the Moon and Mars," a collection of articles exploring the critical role of water on the Moon and Mars for human exploration, which was published in the Proceedings of the National Academy of Sciences. He is member of The Royal Society, National Academy of Science and American Academy Arts and Sciences.