

**MARS HUMAN REFERENCE MISSIONS FOR ATMOSPHERE AND CLIMATE: REPORT FROM HEM-SAG.** V. J. Hipkin<sup>1</sup>, R. T. Clancy<sup>2</sup>, G. Delory<sup>3</sup>, D. C. Fernandez-Remolar<sup>4</sup>, J. B. Garvin<sup>5</sup>, J. S. Levine<sup>5</sup>, D. W. Beaty<sup>6</sup> and HEM-SAG team; <sup>1</sup>Canadian Space Agency, St-Hubert, Quebec, Canada, [Victoria.Hipkin@space.gc.ca](mailto:Victoria.Hipkin@space.gc.ca), <sup>2</sup>Space Science Institute, Boulder, Colorado; <sup>3</sup>Space Sciences Laboratory & Center for Integrative Planetary Sciences, University of California, Berkeley; <sup>4</sup>Centro de Astrobiología, CSIC-INTA, Torrejón de Ardoz, Spain; <sup>5</sup>NASA Headquarters, Washington DC; <sup>6</sup>Jet Propulsion Laboratory/ California Institute of Technology, Pasadena, California

**Introduction:** To allow current lunar architecture development to feed forward towards the exploration of Mars by humans as outlined in the NASA Vision for Space Exploration (VSE), the NASA Mars Exploration Program Analysis Group (MEPAG), formed a Human Exploration of Mars Science Analysis Group (HEM-SAG) in March 2007. The goal of HEM-SAG is to develop the scientific goals and objectives for the scientific exploration of Mars by humans. The HEM-SAG was one of several parallel NASA humans to Mars scientific, engineering and mission architecture studies going on in 2007 to support NASA's planning for the VSE.

2006 MEPAG GOAL II atmosphere and climate objectives include global and local investigations of Mars atmosphere dynamics and composition, and aeronomy and surface investigations to unlock the mysteries of Mars past climate. Under HEM-SAG, 2006 MEPAG Goal II objectives were refocused to look at relevance to the 2030 timeframe, site dependency and human-enabled operations.

**Results:** Three areas of science priority were developed with essentially different surface operations characteristics: generic atmospheric boundary layer and trace gas investigations, access to the polar cap climate record, and study of the early evolution of Mars using the geological record.

Reference mission activities that would take place at all human sites given a need to characterize local atmospheric conditions, and a polar cap reference mission, are presented for comment and input from the community. The polar cap reference mission presents science objectives for deep drilling (>1km) and considers the constraints of polar night.