

NASA/Haughton-Mars Project (HMP) 2006 Lunar Medical Contingency Simulation at Devon Island

R.A. Scheuring¹, J.A. Jones², P. Lee³, J.M. Comtois⁴, S. Chappell⁵, A. Rafiq⁶, S. Braham⁷, E. Hodgson⁸, P. Sullivan⁴, N. Wilkinson³, D. Bach⁹, S. Torney²

¹University of Texas Medical Branch at Galveston/Wyle Laboratories, Houston, TX; ²NASA-Johnson Space Center, Houston, TX; ³Haughton-Mars Project/Mars Institute, Vancouver, BC; ⁴Canadian Space Agency, Montreal, Canada; ⁵Colorado Rocky Mountain Rescue, Boulder, CO; ⁶Virginia Commonwealth University, Richmond, VA; ⁷Simon Fraser University, Vancouver, BC; ⁸Hamilton-Sundstrand Space, Land & Sea, Windsor Locks, CT; ⁹Wyle Laboratories, Inc., Houston, TX

Introduction: The lunar architecture for future sortie and outpost missions will require humans to serve on the lunar surface from an initial 7 days to 6 months, considerably longer than the Apollo moon missions. Although the Apollo crewmembers sustained few injuries during their brief lunar surface activity, injuries did occur and are a concern for the longer lunar stays. Interestingly, lunar medical contingency plans were not developed during Apollo. In order to develop an evidence-base for handling a medical contingency on the lunar surface, a project using the moon-Mars analog environment at Devon Island, Nunavut, high Canadian Arctic was conducted. Objectives of this study included establishing audio/visual and biomedical data connectivity to multiple centers, testing rescue/extraction hardware and procedures, evaluating in suit increased oxygen consumption, and effective management strategies for dealing with an incapacitated crewmember on the lunar surface.

Methods: A review of the Apollo lunar surface activities and personal communications with Apollo lunar crewmembers provided the knowledge base of plausible scenarios that could potentially injure an astronaut during a lunar extravehicular activity (EVA). Objectives were established to demonstrate stabilization and transfer of an injured crewmember and communication with ground controllers at multiple mission control centers. **Results:** The project objectives were successfully achieved during the simulation. Among these objectives were extraction from a sloped terrain by a two-member crew in a 1 g analog environment, establishing real-time communication to multiple centers, providing biomedical data to flight controllers and crewmembers, and establishing a medical diagnosis and treatment plan from a remote site.

Discussion: The simulation provided evidence for the types of equipment and methods for performing extraction of an injured crewmember from a sloped terrain. Additionally, the necessary communications infrastructure to connect multiple centers worldwide was established from a remote site. The surface crewmembers were confronted with a number of unexpected scenarios including environmental, communications, EVA suit, and navigation challenges during the course of the simulation which provided insight into the challenges of carrying out a medical contingency in an austere environment. The knowledge gained from

completing the objectives will be incorporated into the exploration medical requirements involving an incapacitated astronaut on the lunar surface.