

IAF SPACE EXPLORATION SYMPOSIUM (A3)  
Moon Exploration – Part 3 (2C)

Author: Prof. Gordon Osinski  
University of Western Ontario (UWO), Canada

Dr. Matthew Bourassa  
The Institute for Earth and Space Exploration, Canada  
Dr. Matthew Cross  
University of Western Ontario (UWO), Canada  
Mr. Patrick Hill  
Centre for Planetary Science and Exploration(CPSX), Canada  
Mr. Derek King  
Centre for Planetary Science and Exploration(CPSX), Canada  
Dr. Zach Morse  
Centre for Planetary Science and Exploration(CPSX), Canada  
Dr. Eric Pilles  
Centre for Planetary Science and Exploration(CPSX), Canada  
Mr. Gavin Tolometti  
Centre for Planetary Science and Exploration(CPSX), Canada  
Dr. Livio Tornabene  
Centre for Planetary Science and Exploration(CPSX), Canada

A CANADIAN SCIENCE MATURATION STUDY FOR A LUNAR SAMPLE RETURN ROVER TO  
SCHRÖDINGER BASIN AS PART OF THE HERACLES MISSION CONCEPT**Abstract**

Future robotic exploration of the Moon is necessary as a precursor for human exploration not only for testing critical technologies required for a long-term human presence on the Moon, but also for performing reconnaissance to gain a better understanding of the area of investigation before humans return to the surface. The Human Enabled Robotic Architecture and Capability for Lunar Exploration and Science (HERACLES) is a mission concept to prepare for human lunar exploration and gain knowledge in science and exploration. HERACLES is an international partnership between the European Space Agency (ESA), the Japanese Aerospace Exploration Agency (JAXA), and the Canadian Space Agency (CSA). A component of the HERACLES architecture is the Precursor to Human and Scientific Rover (PHASR) element that would act as a robotic precursor.

CSA awarded a two-year contract to our team at Western University to perform a Science Maturation Study (SMS) to mature and validate the preliminary science requirements of PHASR for the HERACLES mission and develop a preliminary science scenario. PHASR is tentatively planned to land in Schrödinger Basin on the lunar far side and collect samples over a 70-day period. The samples would then be returned to the ascent vehicle which would rendezvous with the proposed Lunar Gateway and eventually return to Earth. After the ascent vehicle has left the lunar surface, the rover would continue to explore Schrödinger Basin for another year to perform follow-up science.

The purpose of the SMS was to define the science goals and objectives for PHASR and define the

baseline science investigation. This entailed selecting the appropriate payloads needed to achieve the science goals/objectives and developing a traceability matrix to define the relationships between the science objectives and the payloads, and the required measurement parameters needed. The baseline science investigation also includes a nominal traverse plan for the rover based on mission parameters provided by CSA. The final task was to develop a science plan as part of the recommendation of a payload that Canada could contribute to the PHASR mission.

The results of this SMS will aid Canada in its future contributions to the HERACLES mission as part of an international effort to return humans to the lunar surface.