Development of an Integrated Vision System for the Precursor to Human and Scientific Rover (PHASR) as a Potential Canadian Contribution to the Proposed HERACLES Mission

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Abstract: 2062

INSTRUMENT CONCEPT

The study involved developing a science instrument for PHASR that could be developed and operated by a Canadian team that the Canadian Space Agency (CSA) could contribute to the HERACLES mission [Abstract 2418]. Our team has proposed an Integrated Vision System (IVS) which combines a science colour camera, a LiDAR, and a spectral imager. The IVS would integrate three types of vision systems into a unified instrument which would enable rapid fusion of the necessary data products to support the science team to make near real-time decisions for a sample return mission. It would also facilitate data synthesis to allow for rapid science (progression from observations to results). In addition to performing critical observational tasks as part of the science surrounding the sample return mission, the IVS may also be used as an engineering instrument supporting rover navigation. With its LiDAR and high definition camera, the IVS can be integrated into localization and control functions to drive the rover as well as to guide the robotic arm of the rover for contact measurements and sample collection precision.

INSTRUMENT SCIENCE OBJECTIVES

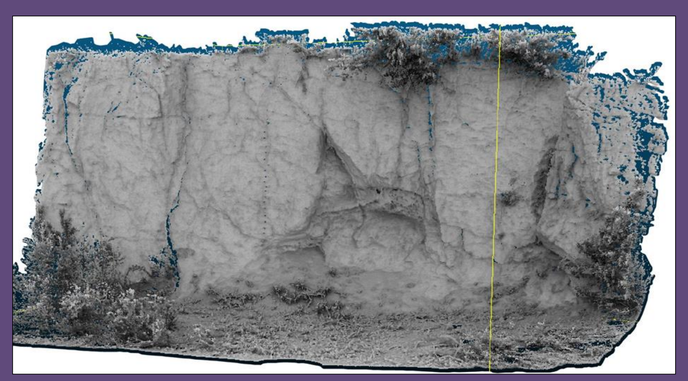
- Support the selection of return samples
- Characterize the mineralogical diversity of the basin (and/or basaltic flows depending on location) along a multi-km traverse
- Ground-truth orbital datasets (e.g. Clementine, SELENE, or Chandrayaan-1)
- Create outcrop-scale geologic and terrain maps along a multi-km traverse in preparation for human return

INTEGRATED VISION SYSTEM (IVS)

SCIENCE CAMERA

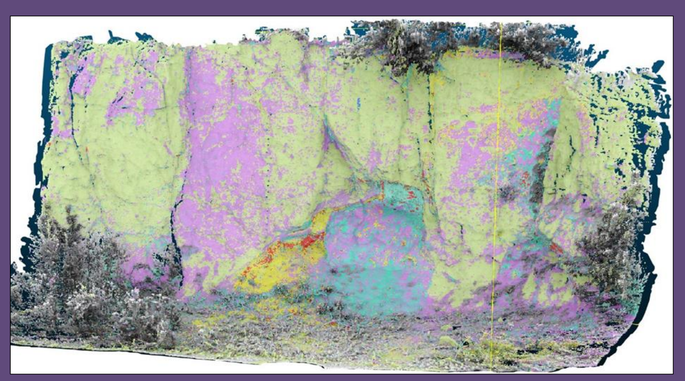
A high definition colour camera with a built-in spectral filter wheel (UV-VIS-NIR) to obtain images and spectral data of the lunar surface, targets of interest, and collected samples.

LIDAR



A Light Detecting and Ranging sensor to model the surface environment, analyze the topography, produce a hazard map for future human activity, and map the surface terrain to understand its formation.

SPECTRAL IMAGER



A multi-spectral imaging spectrometer (~800 to 2500 nm) to measure spectral reflectance to interpret the surrounding mineralogy, and identify targets of interest.

INSTRUMENT SYNERGY

The concept of the IVS was conceived specifically for its potential synergy with another stand-off instrument, a Raman/LIBS/Zoom Camera (e.g. Supercam). The IVS will collect data from its entire surroundings and does not require specific pointing. The Raman/LIBS/Zoom Camera, conversely, will collect data by pointing at specific targets. This two-tiered stand-off instrument approach would operate in sequence to enable effectual target down-selection in order to select the best lunar samples for further analysis and to return to Earth.

FUTURE DEVELOPMENT

2019-2021	Prototype and Analogue Test Data
2021-2023	Calibration using Engineering Model
2023-2025	Flight Model Data
2025	Mission Operations
2026	Publication of Results

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