

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

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ADAPTING AN OPEN-ARCHITECTURE MISSION OPERATIONS SYSTEM FOR A LUNAR ROVER  
MISSION**Abstract**

The Hawaii Space Flight Laboratory (HSFL) of the University of Hawaii at Manoa under a NASA grant is developing a comprehensive open-architecture space mission operations system (COSMOS) designed especially to provide operations support for multiple small spacecraft. HSFL is on a Canadian-led team to perform a conceptual study for the Canadian Space Agency on the feasibility of doing a micro-rover (30 kg) landed mission to the Moon for no more than \$100 million. This potential mission, based on international collaborations, is called the Canadian American British Lunar Explorer (CABLE) mission. CABLE is a landed lunar mission concept encompassing a low-cost launcher and planetary transfer vehicle, a soft lander with hazard avoidance capability, and a highly-capable microRover based on the Canadian Kapvik prototype. As part of the CABLE mission plan, the Inter-Stage Adapter that is used to provide support for the lander during launch and also propellant for following propulsive burns, after separation becomes a cis-lunar spacecraft called ISAS to provide measurements of the environment in cis-lunar space. This paper examines the adaption of the COSMOS system to provide operations support for the CABLE mission. It was determined during the study that not only is COSMOS suitable for supporting operations for the lander spacecraft and ISAS, it could also provide operations support for the lunar rover. For monitor and control of the two spacecraft and rover we are using the Mission Operations Support Tool (MOST) of COSMOS. This tool, which is based on the LUNOPS tool developed for the Clementine lunar mission in 1994, also provides monitoring of the mission trajectories, including the descent and landing on the Moon. Working prototypes of MOST to demonstrate these capabilities were completed for the CSA study. To further demonstrate the suitability of COSMOS and MOST to support lunar operations, MOST was used in a student project at the University of Hawaii at Manoa to provide operations for a simulated Mars lander and rover mission. It is also planned to use a version of the CABLE MOST

software to assist the second field deployment of the CSA Mars Methane Mission (MMM) in a terrestrial analogue. This will employ the Kapvik microRover to conduct field-investigations simulating a remote Mars mission in a serpentinite geology relevant to Mars to verify the methodologies and instrumentation for the in-situ search for methane sources and relevant microbial biosignatures related to methanogens.