LAVA TUBE ANALOG MISSION FOR LUNAR SCIENCE AND HUMAN PERFORMANCE STUDIES.

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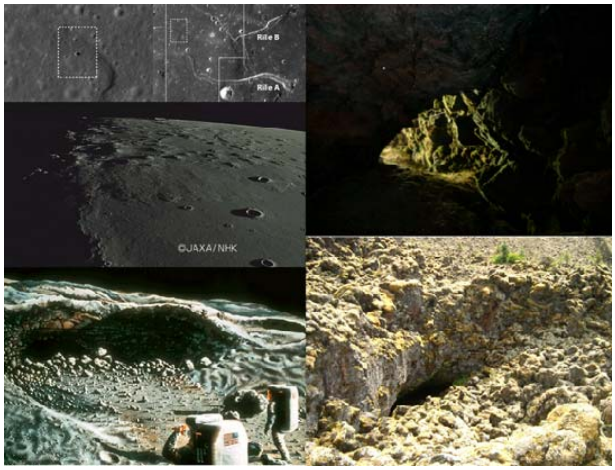
Introduction: The recent discovery by the science team of the Japanese Kaguya lunar sensing satellite of a "skylight" or cave opening in the area of the Moon's Marius Hills region is a potentially important find for the existence of intact lunar lava tubes. This discovery raises the specter of investigative science focusing remote sensing efforts for planning robotic and eventually human expeditions to these subsurface environments for in situ investigations. For science, understanding the geologic processes associated with ancient lunar basaltic lava flows is needed for mapping the distribution and age of bedrock at the surface. The layered sequence of lava flows, piled one on top of another, preserves a record of the composition and mineralogy of the domains in the Moon's mantle that melted over time. For human habitation, the benefits of using natural caverns such as lava tubes on the moon as receptacles for habitation stuctures or as protective shelter has been around since at least 1985, when first proposed by Hörz[1], citing examples of natural environment protection against meteorite impact, radiation protection, benign constant-temperature environment, and flexibility in use of lightweight building materials.

Lava Tube Analog Mission Testbed: Operationally, a major downside for exploitation of lava tubes for both science investigations and habitability are issues of difficult accessibility to cave entrances or surface openings. The operational scenarios, technologies, and human and robotic performance feats associated with planetary cave exploration can be benefited by terrestrial analog mission testbeds.

Nisga'a Memorial Lava Bed Park: Certain geomorphologic features found at the Nisga'a Memorial Lava Bed Park in British Columbia, Canada can serve as a terrestrial analog site for science research and testing of mission operations to lunar subsurface sites. We propose an analog mission investigating required science measurements with human performance objectives simulating robotic and human "first contact" with a lunar lava tube. The proposed geographic location for conducting the analog studies are within the protected area of the Nisga'a Lava Bed in proximity to the Tseax River Cone or Aiyansh Volcano where unmapped lava tubes exist.

Skylight Discovered at Moon's Marius Hills Region

Nisga'a Lava Tube Entrance



1st Human Expedition to a Lunar Lava Tube (NASA Image)

Nisga'a Lava Tube Analog Site

Scope and Objectives of the Research: The idea is to get some understanding of first robotic and human contact with a lunar lava tube through the use of comparable terrestrial lava tube features. Basic scientific understanding of the features is necessary to locate them on the Moon as well as techniques of entering and examining them robotically and by Astronauts.

Proposed Methodology: Essentially we simulate a first scientific expedition to a lunar lava tube. By simulating missions to the features on Earth researchers can better understand direction and techniques of exploration of those features on the Moon. An international team of planetary scientists, caving and mining experts, robotic experts, and human performance experts has been assembled to investigate the best path for technology development and how sampling and science can be done on the lunar surface and underground.

References: [1] Hörz, Friedrich, In Lunar Bases and Space Activities of the 21st Century, W.W. Mendell, ed., 1985, LPI, Houston, TX, p 405-412.