



The Research and Technology Development in Planetary Cave Exploration

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DESCRIPTION

The probability of lunar lava tube caves using mathematical models. They have now collected data on caves throughout our solar system using a variety of orbiting and fly-by satellites as well as survey instrumentation, and they have identified probable cave entrances on the Moon, Mars, and at least nine additional planetary bodies. These finds sparked an interest in planetary cave research. They tapped into the knowledge of an interdisciplinary team to develop a plan for exploring caverns outside of Earth in order to improve this field. Our objective was to create a framework to direct this sub discipline for at least the next ten years, focusing especially on astrobiology, the cave environment, geology, robots, equipment, and human exploration.

This exercise led to the identification of new, vital study areas that need to be thoroughly developed in order to support a robotic mission to a planetary cave in the future primarily the Moon and/or Mars. The research and technology development required to make these essential improvements during the following ten years is doable with the right financial investment and institutional backing. They will then be in a position to use robots to explore lunar tunnels and look for signs of life in Martian caves, which would pave the way for human exploration and potential colonisation of both the lunar and Martian surface.

To effectively explore a planetary cave, such a mission will ultimately require cross-planetary-body investigations spanning multiple disciplines including astrobiology, climatology, geology, robotics and instrumentation, human exploration, and operations. Given the inherent interdisciplinary nature of planetary cave science and exploration, they assembled a team of engineers, roboticists, astrobiologists, geologists, and physicists to conduct an expert-opinion-based and systematic social survey, often referred to as a “horizon scan.” Our goal was to identify emerging and crucial research areas that require robust development to facilitate and support a successful robotic mission to a planetary cave principally the Moon and/or Mars that could ultimately lay the foundation for human cave exploration and habitation.

Over the past decade, horizon scans, which employ an expert-opinion-based paradigm, have been used to obtain insights and identify future directions into panoply of medical, societal, and environmental research areas. These include identification of emerging technologies in cancer research and bioengineering, storm and waste-water management, improvement of management policies for governmental agencies, and the identification of future directions in ecology, as well as annual assessments on global biological conservation issues, to our knowledge, this is the first occasion where a horizon scan approach was applied to identify research priorities in planetary science or space exploration.

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