21st IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT (D3)
Strategies & Architectures as the Framework for Future Building Blocks in Space Exploration and Development (1)

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RISK MAPPING FOR SUSTAINABLE LONG-TERM EXPLORATION OF THE CISLUNAR ENVIRONMENT

Abstract

The first half of the 2000s has seen an explosion of missions headed toward the moon. Leading space-faring nations have announced critical missions to the lunar surface, considering crewed ones, government consortiums are developing stations on lunar orbit, and companies worldwide are developing equipment for use on lunar orbit and the lunar surface, starting with the lunar gateway and Artemis mission.

As an outcome of these developments, the latter half of the 2000s will be marked by an increased potential conflict of the cislunar environment between governments, regulatory bodies, companies, affecting missions and astronauts living or transiting the moon. This paper showcases the various risk factors contributing to the escalating complexity of lunar operations, and assesses their impact on long-term sustainable utilization of cislunar space across three categories.

Category 1 risks are technical risks including systems, communications, transportation, resource utilization, and life support for crewed habitat. Technical risks address gaps for a more complete cislunar infrastructure, and solution providers focus heavily cooperations between for-profit firms. Category 2 risks are operative risks including redundancy planning, accidents and relief/rescue, lunar debris, and overlap of mission goals such as the key regions of Lagrangian points, lunar poles, and transit orbits. Taking in consideration the previous challenges that the ISS had. Operative risks demand new operative norms, mitigative procedures, and best practices, and require the attention of regulatory bodies or commercial consortiums. Category 3 risks are strategic risks including ownership and commerce of lunar resources, governance of peoples in cislunar space, and requirements and liabilities of cislunar activities. Strategic risks impact the long-term peaceful coexistence of cislunar actors, and are formed via agreements between governments and other multinational bodies that can enforce long-term directives.

The research showcases the risk categories and their impact on the planning and management of future cislunar missions. The results of this study will be useful for future corporate venture cooperatives, insurance schemes, and quasi legal arguments.