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PIONEERING LUNAR CONNECTIVITY: SOUTH KOREA'S ROLE IN 5G INFRASTRUCTURE FOR SPACE EXPLORATION

Abstract

The establishment of a 5G communications network infrastructure on the lunar surface represents a significant opportunity to advance international cooperation in space exploration. As a global leader in communications technology and infrastructure, South Korea is uniquely positioned to contribute to international space exploration programmes through its cutting-edge 5G capabilities. By leveraging high-speed data transmission and stable communication technologies, South Korea can strengthen its role in global space development and promote cooperation with other nations to share advanced technologies.

This research underscores the increasing demand for robust communication and navigation systems to support the growing number of lunar missions involving crewed and robotic activities. Traditional Earth-based systems are insufficient to meet the needs of modern lunar operations, and a dedicated infrastructure needs to be developed. Key technological challenges include the design of digital radio frequency and optical communication terminals optimised for the lunar environment, network integration and interoperability standardisation.

The urgency of this research is to ensure technological leadership and stimulate industrial growth. Space communication technologies are central to high-value industries, offering opportunities to stimulate economic growth, create new markets and drive innovation across sectors. In addition, such advances have significant implications for national security, enabling real-time information sharing, command efficiency and improved situational awareness in military and civil protection operations.

This study proposes a structured approach to developing South Korea's lunar 5G communications capabilities, including strategic collaboration with international partners, comprehensive analysis of the global and domestic technology landscape, and formulation of a long-term roadmap. The research methodology includes evaluating the latest developments in international space exploration programmes, such as NASA's Artemis and China's ILRS, and assessing South Korea's technical capabilities to identify competitive and differentiated areas. Based on these findings, this study outlines a participation strategy for South Korea in lunar 5G communications projects, emphasising the integration of private sector contributions, risk management and the expansion of global partnerships.

By addressing these challenges and opportunities, this study aims to position South Korea as a key player in the space communications sector, strengthening its role in international space exploration initiatives while promoting economic growth and technological innovation domestically.