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# TOWARDS A LUNAR EXPLORATION TECHNOLOGY ADAPTIVE ROADMAP: CONTRIBUTIONS FROM SGAC'S TECHNICAL UNIT RESEARCH FOR A THRIVING LUNAR ECOSYSTEM

## Abstract

In the expansion of humanity's presence beyond Earth, the Moon will play a key role both as a stepping stone and as an outpost for deep space operations. For this to occur, it is imperative to begin working towards the integrated development of interoperable technological capabilities that can ensure the thriving development of the Moon. To shed light on these topics, in September 2020, the SGAC Space Exploration Project Group established the Technical Unit Research for a Thriving Lunar Ecosystem (T.U.R.T.L.E.) with the goal to coordinate original and innovative lunar research from the young generations. The T.U.R.T.L.E. Group focuses on five foundational areas: landing sites, logistic coordination, power supplies, biospheres development and dust mitigation. By examining these domains with a holistic approach encompassing their interactions and implications for multi-year, multi-actor scenarios, the research conducted by the Group aims to be instrumental for the global development of a Lunar Exploration Technology Adaptive Roadmap (L.E.T.A.R.). Ultimately, the main goal of the Group is to support the establishment of a circular Lunar ecosystem, an environment where both competition and cooperation can thrive while sustainability is ensured. This paper provides an overview of the project structure and presents the main results achieved by the Group after its first year of research. Based on these findings, the paper demonstrates the usefulness of holistic and concurrent approaches to lunar technology development as enabling instruments to be leveraged by young generations. Please note that this abstract is submitted under the auspices of SGAC, as part of the activities of its Space Exploration Project Group.