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COMPARISON OF ROVER FLEET SYSTEMS DESIGN FOR LUNAR RESOURCE MINING AND
CONSTRUCTION**Abstract**

Unmanned wheeled vehicles, or rovers, are most adequately utilized for lunar missions where extreme temperatures, lack of air, and difficult terrain and logistics make human missions far more costly. Lunar habitat construction missions are best suited for rovers as they require long timelines and tedious work over a large terrain that is made further unsuitable for manned missions.

This study looks at systems designs for a fleet of rovers and the cost and benefits of different fleet systems. The tasks are divided into the steps of (1) identification and exploration of lunar terrain and lunar soil, (2) collection of lunar resources, (3) storage of lunar resources, (4) processing of lunar resources into lunar habitat units, and (5) construction of lunar habitat. Multiple steps can be combined into a single rover type, or can be repeated over different rover types.

The costs and benefits of different approaches are evaluated over the following metrics: (1) area coverage by a given fleet of rovers, (2) level of redundancy of critical tasks, or the risk of failure points or bottlenecks to the overall system, (3) reliability of communication or level of autonomy available, and (4) use of electric power to complete a given cycle of work. All of these metrics are assessed in qualitative low/medium/high levels.

This study does not provide a comprehensive guide to all possible iterations of rover fleet systems design, but rather provides an analysis of the most plausible and effective systems that are most likely to be considered for lunar habitat construction missions. While the study provides metrics to compare one method to another, it also does not present which method is preferable to the other, as the level of risk a party may wish to assume for a mission varies from party to party.

The study concludes with a framework to understand the versatility and reliability of different rover fleet systems for lunar resource mining for habitat construction. The same framework may be applicable to rover fleets in other extraterrestrial bodies or for tasks other than habitat construction.