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NOVEL DESIGN REQUIREMENTS FOR NANO LUNAR ROVERS

**Abstract**

With the development of their ‘CubeR’ nano-rover concept, Neurospace GmbH and their partners, including TU Berlin, have identified a number of novel design requirements in addition to existing CubeSat technologies to facilitate cheap and efficient exploration of the lunar surface. These are driven by certain enabling technologies that will allow low data monitoring and positioning needs which can be combined with a dynamic, ‘mesh-net’ approach on the surface allowing for high data rates and expansion with every new device sent, providing a variety of unique opportunities for development and innovation.

With growing interest in Lunar exploration driven by national governments and promoted by large corporations, there are increasing opportunities for smaller organisations and institutions to capitalize on new transportation opportunities. However, transportation is not the only challenge that needs to be overcome. In order for robust and easily accessible lunar exploration to take place, there needs to be more than low transportation costs. While it is possible to utilise a large number of existing technologies, specifically those developed for the CubeSat industry, and apply them to lunar exploration, the unique differences between Earth Orbit and the Moon drive several divergences from current, off-the-shelf technologies.

The distance between the Earth and the Moon necessitates higher energy, and thus larger scale communication technologies. Additionally, the lack of any nearby navigation references, as well as the lack of a local magnetic field, pose several challenges for pathfinding, which is further exacerbated by the lack of quick and easy communication. In a way, these problems compound each other. While these can be overcome on a case-by-case basis, the individual infrastructure solutions have a high mass and thus a high cost. Therefore, a more sensible approach would be to consolidate these problems, where possible.

To this end, there are a number of infrastructure needs, specifically in the areas of navigation and communication, which must be implemented to allow for lunar exploration to be cheaper and more accessible. These will then drive several novel design requirements.

This paper will highlight what these are and detail the ways in which Neurospace GmbH and their partners propose addressing them. Additionally, by approaching these problems in a standardised, open-source way, it will allow for more widespread adoption and further economies-of-scale to reduce costs. This will enable lunar rovers themselves to remain light weight, while also creating a number of business opportunities to address these needs.