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# CUBER - A SOLUTION FOR LUNAR EXPLORATION

## Abstract

'CubeR' is an open standard approach to lunar rover design with the goal of apply CubeSats as directly as possible to rovers to allow access to the lunar surface in a cost-effective way. This flagship program was created by Neurospace GmbH and their partners, including TU Berlin, with the goal of developing space technologies enhanced by machine-learning applications.

Recently, the reduction in the cost per kilogram to Low Earth Orbit allowed the development of an extensive industry of nanosatellite "CubeSat" technologies. However, it wasn't just the reduction in launch prices that helped drive the explosion in the number of CubeSats, it was also driven by the miniaturization and function integration of elements and embedded systems. An example of which is the PC/104, developed in the late 90s, which not only made it possible to capitalise on the reduced cost for launching these satellites, but also made it cheaper and easier to develop them. This reduced development cost, in turn, created further incentives for easier orbital access, leading to a new generation of low-cost providers tailored to this new market.

With the recent push by the US, China and Europe to explore the Moon, the lunar surface is poised to undergo the same pattern of cost reduction. Companies ranging from SpaceX to Astrobotic are also looking to make access to the lunar surface more efficient, creating an opportunity for small, lightweight, and compact rovers using standardised technologies to democratize lunar exploration and research.

To this end, Neurospace GmbH is developing 'CubeR'. A nano-rover designed to be a direct extension of existing CubeSats. The goal is to not only capitalize on the decades of development in CubeSat technologies, but to also allow for the remaining technological gaps to be closed in a way that allows industry wide standardisation. In this way the same institutions that pushed the CubeSat revolution will be able to do the same for Moon exploration. This will allow more widespread access for research and a greater impact on society.

This paper will look at the historical example given by CubeSats, looking at how the feedback loop of cheaper satellites helped create the incentive for cheaper launch prices. Using this example, it will then outline future opportunities provided on the lunar surface and how open standards will help in this endeavour. It will conclude with 'CubeR' developed by Neurospace GmbH as an example for how to approach these problems.