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Systems and Infrastructures to Implement Sustainable Space Development and Settlement - Systems (2A)

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COMPARISON OF ADDITIVE MANUFACTURING TECHNOLOGIES FOR IN-SITU
CONSTRUCTION AND FABRICATION ON THE MOON**Abstract**

Nowadays, as we are about to make the next major step in space exploration— returning to the Moon, and establishing there a permanent human presence, we have to develop a wide range of technologies for the construction and fabrication on the lunar surface, involving the in-situ resource utilization approach. Using local lunar resources will drastically lower the need for shipping large amounts of construction materials and consumables from Earth, thus becoming a cornerstone for establishing a sustainable future human outpost on the Moon. One of the key in-situ resource utilization technologies under development is the in-situ fabrication of parts and structures from the moon dust by the means of additive manufacturing. This approach helps to produce complex shape parts of various sizes, covering a wide range of possible applications, including the construction of the habitat modules' shelters, launchpads, road paving, and manufacturing of complex parts for infrastructure maintenance. In the present article, we compared different additive manufacturing technologies, which could be utilized for building lunar infrastructure and/or for manufacturing complex precise parts from lunar regolith. We compared alternative 3D-printing techniques, already tested for manufacturing with lunar regolith simulants, by introducing figures of merit, such as energy consumption, Earth-deliverables consumption, and the ultimate compressive strength of the produced samples. Based on the obtained results, we conclude that Cement Contour Crafting and Stereolithography-based additive manufacturing techniques are the most promising solutions for the construction of large-scale outdoor lunar infrastructure and small precise parts, respectively.