Lunar Exploration (2)
Lunar Exploration (1) (1)

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FIRST STEPS TOWARDS A MOON VILLAGE: ASSESSING THE FEASIBILITY OF A SMALL MODULAR LUNAR HABITAT

Abstract

Amongst the rapidly evolving state of the near-term future of crewed space exploration, the consistent end-goal of international lunar exploration plans is to establish a permanent human presence on the Moon: a research station, or "Moon village". Many have envisaged what the advanced stages of Moon village infrastructure could look like. Significant research effort has been applied to the study of structures produced through in-situ resource utilisation and the design of large and sophisticated crew habitats suitable for lengthy stays by visiting astronauts. However, the near-term future of lunar exploration will be characterised by short visits to the lunar surface by astronauts in the frame of the NASA Artemis programme, supported by scientific and logistical payloads delivered by small-to-medium class landers with payload delivery to the lunar surface capability in the region of 1.5 – 5 tonnes. Although the Artemis Human Landing System (HLS) will have a larger payload capability, flight opportunities will be fewer and most likely reserved for crew landing and return missions rather than delivery of infrastructure.

If the first steps towards the creation of a complex, multi-element Moon village are to be taken within the near future, then the outpost elements must be enabled through smaller but more frequent flights. This paper explores the possibility of utilising near-term transport infrastructure to take those first steps towards the Moon village concept. Firstly, a conceptual design of a habitat derived from the strict mass and size constraints of a medium-class lander is analysed and found to be technically feasible. Considering structural, thermal control, and radiation protection requirements, no clear show-stoppers are identified. Secondly, the use-case for such a habitat is studied, and a candidate Concept of Operations - initially featuring month-long stays for 2 astronauts but with increasing mission lengths and crew size as more modules are assembled - is described. Finally, the paper will close with a discussion of the value that the proposed concept adds to lunar exploration efforts, technology development necessities, and a roadmap for the assembly of a lunar outpost based on the concept and evolution into a Moon village is laid out.