

IAF SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 1 (2A)

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A MOON BASE WITH ACTIVE RADIATION SHIELDING

Abstract

When dealing with human long duration missions beyond low Earth orbit the danger due to radiation must be carefully accounted for. This is even more important when dealing with missions aimed to the constructions of outposts on the Moon and on Mars, aimed to the colonization of these bodies. The possibility of screening the human beings from radiation by building thick wall habitats, possibly using the locally available regolith through additive manufacturing technologies, is very interesting, but has an intrinsic drawback: the buildings must have windows as small as possible, or no windows at all, which affects the psychological health of the colonists (claustrophobia), to decrease their ability to assess distances when outside the outpost (difficulties in performing EVA) and may be particularly bad in case one of the activities of the outpost is tourism. Another problem is the construction of greenhouses, which should allow the light from the Sun to enter for powering the plants' biological mechanisms. A partial solution to this drawback is virtual windows: large screens attached to the walls, showing images coming from cameras located on the outside of the walls. But the image on a screen is two-dimensional and it is still to evaluate how much the above mentioned problems are mitigated by 2-D images. For the greenhouse the solution may be an extensive use of artificial lighting, mostly using LEDs, but this requires the presence of very powerful electric generators. The proposal of this paper is to study an expandable and modular settlement, made of elements as transparent as possible due to the presence of large windows that allow the view of lunar landscape and celestial vault, as to mitigate psychologically effects derived from long stay away from planet Earth. To make this solution possible, the settlement needs to be protected from the dangerous cosmic radiation using magnetic fields (active radiation shielding). Artificial magnetic fields can be generated by a number of high voltage electric cables arranged in a toroidal geometry around the inhabited environment. This cables are able to generate an external magnetic field of sufficient intensity, to protect the habitat from cosmic radiation and, at the same time, an almost null magnetic field inside the settlements, as to avoid any damage for the inhabitants. In particular, a future moon base can be built within a large size toroid of electric cables.