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USING WALKING POLES TO ASSIST THE MOBILITY OF ASTRONAUTS DURING LUNAR EXTRAVEHICULAR ACTIVITIES

Abstract

Footage of the astronauts on the surface of the Moon during the NASA Apollo missions provide clear evidence of how challenging it was to perform regular activities while wearing a space suit in reduced gravity in the vacuum of space. Activities like walking, kneeling, bending over, taking a picture, or reaching for something on the lunar surface, proved to be very difficult to execute when performing extravehicular activities. The overall rigidity of the suit, the reduced gravity, and the lack of familiarity with such reduced gravity, made the operations on the Moon surface very risky. One of the greatest risks was when astronauts were traversing the surface of the Moon by trying to walk or "bunny hop" and then suddenly they fell-off. Each fall puts the life of the astronaut at risk due to the possible helmet or suit damage with sharp rocks or lunar regolith. Also, the footage shows that traversing the surface by walking was not efficient nor effective, opting for the hopping as a more effective, yet less controlled way to move from one point to another. For this reason, this paper investigates the possibility of using walking poles to assist the mobility of astronauts during ExtraVehicular Activities (EVA) on the Moon. Multiple test subjects performed simulated lunar EVAs in a fully-pressurized space suit under lunar-gravity conditions provided by a gravity offset located on a lunar yard. During the simulation the test subjects evaluated multiple scenarios to traverse the lunar yard: walking, hopping, walking with one pole, walking with two poles, hopping with one pole, and hopping with two poles. The results indicate that in lunar gravity, the use of two walking poles significantly improves the overall stability of the astronaut, allowing for a more effective and easier way to traverse the surface. This improvement becomes more apparent when hopping, rather than when walking, because hopping reduces the "fight" against the rigidity of the suit. The use of one hiking pole helps but it is not recommended when hoping because it can create an asymmetry in the support which is difficult to control in reduced gravity. When walking, such asymmetry is easier to control because the astronaut has at least one foot is on the surface.