

Life support Challenges for Human Space Exploration (10)  
Supporting Crews for Exploration Missions (2)

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THE MOON DUST PROJECT: DESIGNING EXTRA-TERRESTRIAL HABITAT FROM THE  
ASTRONAUTS' MOVEMENTS**Abstract**

When designing habitats for extra-terrestrial exploration, engineers and architects make assumptions about the effect of gravity on astronauts' movements and perception of space. The problem of barely knowing how humans move in reduced gravity raises question such as how high the steps of a stair on the Moon should be and how much space an astronaut needs to turn around or to walk. Although several studies exist on the topic, the current examples of extra-terrestrial habitats are more laboratories than real "homes". For longer stays, or further distances, comfort and ergonomics may become an increasingly important issue. The Moon Dust project investigated if monitoring movement before designing the architecture of space habitats around these measurements could answer those questions.

Practically, an actor dressed up with a motion capture suit executed the movements. Typical scenes from the everyday life were executed: eating, dressing up, doing laboratory work, etc. This was all performed reproductions of some the modules of the ISS, based on videos of astronauts in microgravity. Some other scenes were performed in an open space, without any kind of obstacles, in order to analyze more spontaneous movements.

Thanks to the motion capture technology, a digital copy of the moving body was assessed. Based on the measured kinematics, the occupied volume was drawn and the discussion on how that space could be transformed into a habitat started. That discussion included comparisons with existing habitat concepts, and engineering solutions that could be applied to architecture such as three-dimension printing.

The next step to take would be to bring those investigations in reduced gravity, whether it is on parabolic flights or on-board a space station. The scientific insight gained from the results obtained in microgravity, will lead to a new singular instrument establishing a new minimum standard and set of tools for the design of extra-terrestrial architecture based on changes through time. This is necessary if the architecture of space vehicles and bases are to be designed along the lines not only of ergonomics but ergonomics in time.

In addition to these results, the Moon Dust project is a very good example of international collaboration between architects and engineers on the issue of extra-terrestrial habitat.