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SAFETY ANALYSIS OF SPACESUIT DESIGN FOR MARTIAN SURFACE

Abstract

Mars is often seen as the next logical step in human exploration of the Solar System. This interest in Mars is linked with its resources and environment, which could help sustain long term human presence, and answer the crucial question, "Can life arise outside our planet?". In the past, Mars presented environmental conditions that might have been able to support life as known on earth, including liquid water and a dense atmosphere. However, the evolution of Mars has rendered its surface environment inhospitable for all currently known life forms. Extravehicular Activities (EVAs) will play a crucial role in any human Mars mission, not only to achieve scientific goals, but also to help maintain the mission facilities and hardware. The most critical piece of equipment in an EVA is the spacesuit. Current spacesuit designs are restrictive in terms of mobility and operability, and are designed to work only in micro-gravity environments. Therefore, designing a spacesuit capable of shielding the astronauts from the harsh environment of Mars, and allowing the execution of frequent, physically-demanding EVAs is critical for future Mars exploration missions. In this paper, the major hazards associated with spacesuit operations on the Martian surface are investigated. This includes definition of the associated risks, and identification of procedures, technologies, and countermeasures that can reduce these risks. Hazards are studied with a focus on the different subsystems and equipment of a spacesuit. These include thermal and pressure control, life support, power control and distribution as well as radiation protection. Human factors such as mobility and operability of the suit are also discussed.