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EXPLORATION ATMOSPHERES FOR BEYOND-LEO HUMAN EXPLORATION MISSIONS

Abstract

Atmospheric pressure and oxygen concentration of human-occupied space vehicles and habitats are important life support and health parameters. The atmosphere is critical in terms of not only safety but also in terms of maximizing human capabilities at the point of scientific discovery. Human exploration missions beyond low earth orbit (LEO) will include extravehicular activity (EVA). EVAs are carried out in low pressure (4.3 psia/29.6 kilopascals) space suits running at 100 percent oxygen. New suits currently in development will be capable of running at a range of pressures between approximately 8.2 psia/56.5 kilopascals and 4.3 psia/29.6 kilopascals. In order to carry out high-frequency EVA phases of a mission safely and more efficiently, it is advantageous to have cabin or vehicle atmospheres at lower total pressure and higher oxygen concentrations. This allows for much reduced pre-breathe times for a fixed risk of decompression sickness and thus more efficient EVAs. The recommended oxygen concentration is 34 percent and represents a trade with respect to controlling the risk of decompression sickness and risk of fire. The recommended total pressure is 8.2 psia/56.5 kilopascals Work carried out by NASA in 2006 and continued in 2012 established an atmospheric pressure and oxygen concentration to optimize EVA. This paper will review previous work and describe current recommendations for beyond-LEO human exploration missions.