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# Development of a Mars Environmental Control and Life Support System (ECLSS)

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**ECLS systems for very long-duration human missions to Mars will be designed to operate reliably for many years and will never be returned to Earth. The need for high reliability is driven by unsympathetic abort scenarios. Abort from a Mars mission could be as long as 450 days to return to Earth. Simply put, the goal of an ECLSS is to duplicate the functions the Earth provides in terms of human living and working on our home planet but without the benefit of the Earth's large buffers – the atmospheres, the oceans and land masses. With small buffers a space-based ECLSS must operate as a true dynamic system rather than independent processors taking things from tanks, processing them, and then returning them to product tanks. Key is a development process that allows for a logical sequence of validating successful development (maturation) in a stepwise manner with key performance parameters (KPPs) at each step; especially KPPs for technologies evaluated in a full systems context with human crews on Earth and on space platforms such as the ISS. This paper will explore the implications of such an approach to ECLSS development and the roles of ground and space-based testing necessary to develop a highly reliable life support system for long duration human exploration missions. Historical development and testing of ECLS systems from Mercury to the International Space Station (ISS) will be reviewed. Current work as well as recommendations for future work will be described.**

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