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ISS Technology for Manned Mars Missions? A critical Engineering Assessment

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The author has more than 25 years experience in the development of manned space systems. He takes in his presentation a closer look to the real readiness of ISS technologies for deep space missions lasting 3 years or longer and points to the shortcomings to be remedied.

It appears that the ISS provides humans for now more than 10 years a safe living and working environment similar to what one needs for a manned Mars mission lasting only 3 to 5 years. In particular the ECLS of the ISS as the technologically most challenging system has a long development history with the Apollo, Shuttle and Spacelab programs and should therefore be a candidate for future long duration missions. But is this so?

In contrast to the ISS, manned space vehicles, but also all other systems for long duration deep space missions must function for several years without the possibility of re-supply of failing equipment from Earth and without human intervention capability for unattended systems such as infrastructure elements installed on Mars prior to landing men on Mars. This requires revisiting the design of equipment, improving its reliability and maintainability, and planning for repair and spares in a quite different manner than experienced so far with the ISS and the short-duration Apollo, Shuttle and Spacelab missions. It is quite possible that the resulting needs will increase the mass estimates made so far for manned Mars missions, increase mission complexity and demand new development and test.