Deep Space Habitat ECLS Design Concept

Su Curley, Imelda Stambaugh, Mike Swickrath, Molly Anderson, Hank Rotter
NASA

Life support is vital to human spaceflight, and most current life support systems employ single-use hardware or regenerable technologies that throw away the waste products, relying on resupply to make up the consumables lost in the process. Because the long-term goal of the National Aeronautics and Space Administration is to expand human presence beyond low-earth orbit, life support systems must become self-sustaining for missions where resupply is not practical. From May through October 2011, the life support team at the Johnson Space Center was challenged to define requirements, develop a system concept, and create a preliminary life support system design for a non-planetary Deep Space Habitat that could sustain a crew of four in near earth orbit for a duration of 388 days. Some of the preferred technology choices to support this architecture were passed over as the mission definition also has an unmanned portion lasting 825 days. The main portion of the architecture was derived from technologies currently integrated on the International Space Station as well as upcoming technologies with moderate Technology Readiness Levels. The final architecture concept contains only partially-closed air and water systems, as the breakeven point for some of the closure technologies was not achieved with the mission duration.