

## A Discussion of Integrated Life Support and In Situ Resource Utilization Architectures for Mars Surface Missions

### Abstract:

Life support on the International Space Station is made possible by a combination of technologies to ensure the availability of clean water and air for the crew. Resources, including water and oxygen, are partially recovered and recycled; the balance is lost as waste either to space or incinerated during reentry into Earth's atmosphere. Frequent resupply cargo is provided to ISS to replace these lost resources. For missions beyond Low Earth Orbit, resupply becomes increasingly challenging both economically and logistically. To limit the need for these resupply missions, three options are available: increase the recovery and recycling of necessary materials, leverage *in situ* resources available for a given mission, or a combination of both. Here we discuss several basic life support and *in situ* resource utilization (ISRU) architectures, identify common technologies, propose possible integrated architectures, identify benefits of and challenges to varying levels of life support and ISRU integration, and discuss several considerations for technology commonality, dis-similar redundancy, and developmental overlap.