Abstract:
The evaluation of bioregenerative concepts for human life support in space requires continued testing and upgrading of associated hardware and control systems. We particularly need to explore and test small (low mass), energy efficient hardware that meets the reliability criteria for space related missions.

This includes:
- Development and testing of advanced monitoring and control sensors and software
- Integration of advanced lighting concepts for plant production, including the use of high-intensity discharge, light-emitting diodes, and other novel lamps
- Development of efficient light collection, conduit, and distribution systems
- Development and testing of bioreactor designs for waste treatment/resource recovery in closed systems
- Development and testing of biosensors for monitoring and managing microbial processes associated with life support systems
- Development and testing of solid/liquid/air systems with respect to nutrient delivery, phase and species separation, and applications in microgravity
- Testing and construction of inflatable materials/structures that might be used to enclose bioregenerative systems for planetary surfaces

Related engineering projects exist to support the development and improvement of plant growth hardware for the Space Shuttle mid-deck and Space Station racks, including integration of energy efficient lighting concepts, innovative thermal management, humidity control and condensate recovery, and advanced monitoring and control strategies.