

Ground-based demonstration chambers in NASA's Advanced Life Support Project

R.E. Fortson

Lockheed Martin Space Operations, Johnson Space Center - Mail Code C77, Houston, Texas, USA (Email: russ.e.fortson1@jsc.nasa.gov)

In order to more fully explore and develop space, the National Aeronautics and Space Administration (NASA) is conducting research and technology development of advanced life support (ALS) systems. These regenerative life support systems will reduce the risk and cost of long-duration space missions. The ALS Project encompasses both flight (microgravity) and planetary surface (hypogravity) life support systems, with associated flight- and ground-based testing. This paper will cover the ground-based chambers used by NASA for integrating and testing advanced life support systems.

A complete life support system is composed of several different technologies. Air revitalization, water recovery, solid waste processing, biomass production, food processing, thermal control, human accommodation and integrated computer monitoring and control are all integrated into one complete advanced life support system. Both biological and physicochemical processes are used in these systems. Development work has primarily occurred at three NASA Field Centers: the Ames Research Center (ARC) in California, the Kennedy Space Center (KSC) in Florida, and the Johnson Space Center (JSC) in Texas. JSC is responsible for the complete integration and testing of these systems, including testing with humans.

A combination of commercial plant growth chambers and custom-built chambers is used throughout all three NASA centres involved in the ALS Project. ARC focuses on physicochemical processes for air, water, and solid waste recovery. KSC focuses on biological processes for plant growth, and air, water, and solid waste recovery. JSC, in addition to managing the ALS Program, focuses on implementing the individual technologies for specific flight purposes, plus integrating all the technologies into regenerative systems.

At JSC, a series of tests were conducted between 1995-1997 on a combination of physicochemical and biological processes to recycle air and water. Currently, a new facility is being built that will expand on the lessons learned from this test sequence, and will aim to close more completely the mass loop required for human life support. The Bioregenerative Planetary Life Support Systems Test Complex (BIO-Plex) will start testing later in this decade.