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OVERVIEW OF 180-DAY INTEGRATED EXPERIMENT ON CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEM (CELSS)

Abstract

There would be a huge challenge to human survival in the exploration of deep space. In order to investigate the key technology of life support in the deep space exploration and interplanetary mission, Closed Ecological-Cycle Experiment Platform was built up in ShenzhenChina. This platform aims to verify CELS (controlled ecological life support) technology which combines bio-regenerative and physi-chem regenerative technology, and is capable of researching on the circulation of substance in controlled "human-environment" systems. The closed volume of the platform was 1049 m3. It was consist of 4 cabins covering a crew cabin, a life support cabin, a plant cabin and a resource cabin, and has functions of crew working and living support, food production, atmosphere control, waste recycle. It also offers real-time monitoring and control of environmental parameters, quantitative monitoring of the process of substance-circulation in closed environment, and support for human-environment interaction research.

At present, we are preparing an integrated '4-Crews 180-Days' experiment to validate the capability to regenerate of water, air, food, and recycling of waste through the combination of biological and physi-chem regeneration technologies. This experiment is an large-scale ground-based integrated CELSS experiment ,which include following aspects : 1 Study on substance-circulation and its regulation of dynamic balance. a. dynamic regulating methods for multi-channel complex substance covering gas, liquid and solid flow by using biological and chemical regeneration technology. b. Evaluation and establishment of mathematic model for substance flow covering gas, liquid and solid. 2 Study on the synergistic regulating method for series kinds of plant co-cultivation. a. synergistic regulating method for multi-varieties, multi-batches and large-scale plant co-cultivation in an environment with continuous stable atmosphere and food circulation. b. the effect of light, moisture and nutrition on plant photosynthesis, respiration and transpiration efficiency, as well as production quality. 3 sustainable recycling technologies of wastewater and solid waste. a. Efficient and everlasting degradation technologies for wastewater and bio-degradable solid waste by hybrid microbic-reactor and physico-chemical technique. b. Dynamic regulating methods for processing capacity and quality of wastewater and solid waste treatment, reactor exhaust emission and Microbiological Safety. 4 Study on characteristics and regulations of atmospheric environment dynamics

This report will describe in details as follows: 1) the composition of the 'CELSS' test platform, 2) the integrated '4 Crews 180 Days' CELSS test system, 3) the boundary conditions, 4) the research contents and methods.