SYMPOSIUM ON STEPPING STONES TO THE FUTURE: STRATEGIES, ARCHITECTURES, CONCEPTS AND TECHNOLOGIES (D3)
Infrastructures and Systems to Enable International Future Exploration and Utilization of Space (3)

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ON-ORBIT VERIFICATION OF INFLATABLE SPACE TERRARIUM ON THE EXPOSED FACILITY OF THE INTERNATIONAL SPACE STATION

Abstract

Inflatable structure are one of the key technologies to atteain drastic elimination of empty weight of space structures. However, the inflatable structure was not accepted in any othe projects that employs deployable structure. This is probably because the technology of inflatable structure is not yet regarded as sufficient mature, even though the advantages of the inflatable structure are well understood. This fact means that on-orbit verification is required for the practical use of inflatable structures. The authores' group is planning to conduct on-orbit verification mission of inflatable structures. This mission, named "SIMPLE (Space Inflatable Membrane structures Pioneer Long-term Experiments)", is one of the shared experimental installations attached to the Exposed Facility of Kibo Japanese Experimental Module (JEM) of the International Space Station. The Launch is tentatively scheduled in FY2011.

This mission includes three experimental devices: the Inflatable Extention Mast (IEM), the Inflatable Material Experimental Panel (IMP), and the Inflatable Space Terarrium (IST).

This paper gives the detail and current state of the IST. The major objective of this experiment is to verify the long-term (six months) retainment of pressurized membrane structure, which can produce pseudo-atomospheric environment on orbit for the biological habitation or plantation space. Thies technology will extend for greenhouse on the moon/planet, and experimental device of small satellite for biological experiments.

The challenge of the IST is to verify the long-term retainment of pressureized membarne strdutres in which the atomospheric environment is simulated. We use high-strength laminated membrane developed for the stratospheric platform airship to resis tensile force caused by inner atomospheric environment. And airtight bag in installed for leakage efficiency. Deployment test in vacuum chamber and leakage/pressure tests are conducted on ground using the engineering model. On orbit, inner pressure will be basically not controlled after inflation, and temperature will be controlled by switching the halogen light. To evaluate the characteristics of this highly pressureized inflatable structure, it is monitored by using the inner camera and the pressure/thermal sensors. Finally, we are planning to conduct the germination experiment inside the IST to demonstrate the inner environment.