HUMAN EXPLORATION OF THE SOLAR SYSTEM SYMPOSIUM (A5)
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MINI SPACE FARM–A FOOD SELF-SUFFICIENT SYSTEM IN LONG-TERM SPACE MISSION (PATENT PENDING)

Abstract

To date, the space food self-sufficient system is still pending and without it, the manned deep space mission and permanent habitable bases on the planet will be impossible. "Mini Space Farm" is a closed-loop bio-regenerative life support system by rearing of limited species, this system compose of four parts: namely recycling animals (RA), edible animals (EA), plants system and space human. The animal and plant systems include two types: aquatic and terrestrial. All the bio-wastes will be recycled to be food, and partly water and air will be re-circulated by rearing of RA, EA, space plants in this farm system. Here we focus on the function of food regenerative system. The RA has total 6 kind small invertebrate as follows: Housefly Larvae; Mealworm; Superworm; Tubifex ; Cladoceran; Earthworm. Each RA has its specific function in recycling and digesting of the bio-wastes which including the human and animal feces, inedible parts of the plants and animals, food residue and other bio-wastes. The biomass of these six RA, combine with the inedible parts of the space plants, will be used as feedstuff for feeding EA of poultry, aquatics, amphibians, and even livestock. The meat, egg and milk from these EA are taken as human's animal food. The water and nutrition left in the residues after rearing the RA can be recycled by other RA and finally used to fertilize the space plants. The space plants are taken as vegetarian diet, they are crop, vegetable, feeding plants and a unique edible algae. All the RA, EA, space plants can be continuously and solidly fed in tanks, boxes and cages in the same cabin with high density, which form a self-sufficient food regenerative system with minimum volume, weight, energy, labor,cost and high yield in long term space mission, enable independent of food supply from earth. By this way, two kinds of mini space farm models were designed: A cabin model be used on ISS and flight craft, and a greenhouse model be used on planetary habitats. The cabin farm in net volume and weight for 6 crew food supply will be around 4 $M^3 and 500 Kg$.
A greenhouse farm for 6 colonists will be 300 M^2,
it is around 1\50 of Bio Sphere 2 in area and volume.
Our designed SIMCH Habitat can hold these farms easily.