Paper ID: 58803
oral

18th IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FUTURE (D4)
Contribution of Moon Village to Solving Global Societal Issues (2)

Author: Dr. Masato Sakurai
Japan Aerospace Exploration Agency (JAXA), Japan

Prof. Yoshiaki Kitaya
Osaka Prefecture University, Japan

HABITATION IN THE MOON BASE FROM THE VIEWPOINT OF ECOLOGICAL ENGINEERING

Abstract

Recently, there has been great interest in habitation on the Moon and Mars. For achieving human habitation in space, creating survival environment resembling that on Earth is necessary. According to estimates from NASA, the daily energy requirement (2,800 kcal) of one adult male includes 0.62 kg of food (dry weight), 3.08 kg of water, and 0.84 kg of O2 necessary for breathing, and the daily discharge of 0.11 kg of solid materials, 3.42 kg of water, and 1.0 kg of CO2. The total amount of substances that one person takes into the body per day is approximately 4.5 kg, and the total amount of substances discharged each day is the same. In the controlled ecological life support systems (CELSS), animals and humans respire and emit CO2, which plants absorb and fix via photosynthesis for generating O2. Furthermore, since animal excrement and inedible plant parts are oxidized and converted into water, CO2, and other minerals, a supply of O2 for its oxidation and simultaneous generation of CO2 are also absorbed in the process of photosynthesis. Furthermore, plants also aid in the absorption and removal of trace gases which are harmful to humans as well as unpleasant odors. Water evaporated and transpired from cultivated plants is condensed and used as drinking water. The feasibility of achieving long-term manned space missions is, therefore, entirely dependent on crops in CELSS that will play crucial roles in food production, CO2/O2 conversion, and water purification. In space farming, scheduling crop production, obtaining high yields with a rapid turnover rate, and efficiently converting atmospheric CO2 to O2 can be established by precisely controlling environmental variables. Physicochemical systems for environmental control and life support are called ECLSSs that will compensate for system instability of the CELSS based on biological technology. The air revitalization system in the closed ECLSS consists of five subsystems; CO2 removal assembly, trace contaminant control assembly, CO2 reduction assembly, O2 generation assembly, and methane and other trace contaminants decomposing assembly.