

## Study of Air Re-vitalization System for Closed System Aimed to Moon foothold

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<http://www.iat.jaxa.jp/res/adtrg/e01.html>

### INTRODUCTION

In a long-term vision JAXA2025 is to make decision on what to proceed in next-generation human space activities and on whether to initiate the development of Japan human space transportation vehicle on 2015. In order to catch up with American, Russian and Chinese manned space technology, and that Japanese manned space technology would become one of the world's top, we have made our general outline according to our long term vision about life support system and tried to obtain a manned space technology that could seen as an evidence of realization for Japanese manned space program.

In our image of Japanese moon base case study, we concentrate on air and water recycling. Life support system is essential system not only for moon base but also for manned spaceship and space suit. This moon base is composed of air lock, Experimental module (core module) and Habitation module (additional module). Both Experimental module and Air lock are equipped with minimum facility for brief stay.

### AIR REVITALIZATION SYSTEM

In this paper, we mention about air revitalization and water decomposition. First, the 0.04-0.2% carbon dioxide in the atmosphere which is exhaled by astronauts is separated and concentrated to 96% with zeolite. Next, the carbon dioxide is mixed with hydrogen in the presence of a ruthenium catalyst at 300°C and reacts to produce water and methane. Finally, the obtained water is electrolyzed to obtain oxygen and hydrogen. Astronauts then breathe the oxygen and exhale carbon dioxide, and the process repeats. These processes, concentration of carbon dioxide, sabatier reaction, water electrolysis are well known.

The Japanese experimental module (JEM), which standby on the terrestrial for launching to ISS soon, will have a 21% oxygen atmosphere pressurized to 1 atm, the same conditions as on the ground. N<sub>2</sub>/O<sub>2</sub> gases which are transported from the ground are supplied to JEM centrally from the Russian Module. Oxygen gas is also supplied from the Russian electrolysis module Elektron which electrolyzes KOH (potassium hydroxide). The Elektron module is the prime oxygen generator on the ISS for three member crew when no Progress supply vehicle is docked. In an emergency, extra oxygen can be generated by heating KClO<sub>3</sub> (potassium chloride peroxide) to a high temperature.

### CONCLUSION

Manned space flight is a very important aim of space development. In Japan, we have argued whether manned space programs should be continued, and we do not yet have a firm long-term manned space program.

Japan has a lot of accumulation of knowledge for closed ecology experiment facility. Japan should make the most of this knowledge to life support system in space.

It will be necessary to develop advanced technologies to support future manned spaceflight. In order to establish a circulated life support system, a new type of water electrolysis system which dispenses with a gas-liquid separation module was tested. Preliminary data for air revitalization could be taken.