IAF HUMAN SPACEFLIGHT SYMPOSIUM (B3)
Advanced Systems, Technologies, and Innovations for Human Spaceflight (7)

Author: Mr. Pascal Barbier
Air Liquide, France, pascal.barbier@airliquide.com

Dr. Yan Pennec
Air Liquide, France, yan.pennec@airliquide.com
Dr. James Butterworth
Air Liquide, France, james.butterworth@airliquide.com
Dr. Simon Carpentier
Air Liquide, France, simon.carpentier@airliquide.com
Dr. Johannes Witt
European Space Agency (ESA), The Netherlands, Johannes.Witt@esa.int
Mr. Klaus Bockstahler
Airbus Defence & Space, Space Systems, Germany, Klaus.Bockstahler@airbus.com

DEVELOPMENT OF CRYOGENIC AIR PURIFICATION FOR DEEP SPACE APPLICATION

Abstract

Deep space exploration and settlement represents a new frontier for the progress of mankind. From the first stratospheric flight to the Apollo missions, to the International Space Station and in the near future sustainable life on the moon, the occupancy and duration of flights have risen dramatically. This has put increasing demands on life support system capabilities. Currently, adsorbent beds allow trapping of H2O and CO2 rejected by astronauts. Another possible means of trapping these compounds is based on cryogenic freezing. H2O, CO2 and VOC are simply sequestered by cooling the air below each molecule's dew point. Air Liquide has developed a versatile breadboard in collaboration with Airbus and ESA to assess several concepts and technologies for cryogenic trapping. A set of breadboards has been built to compare performance between using Counter-Flow and Regenerative Heat Exchangers/Crystallizers. In this presentation we will describe the underlying concepts of Cryogenic Air purification, preliminary test results, and our development plan perspectives. While not all technological hurdles have been cleared to date, Cryogenic Air Purification appears as a promising path for next generation life support systems. Furthermore, the Technology could also be applicable to In Situ Resource Utilization, specifically Lunar water recovery and purification.