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Author: Mr. Hamed Gamal
Cairo University, Egypt, hamedgamal@hotmail.com

Ms. Monika Johanna Pardo Spiess
Space Generation Advisory Council (SGAC), Germany, johanna.pardo@community.isunet.edu

Ms. Bora Aliaj
International Space University (ISU), Albania, bora.aliaj.ba@gmail.com

Ms. Liz Barrow
United Kingdom, liz.cdb@hotmail.com

Mr. Mahmoud Afouna
Cairo University, Egypt, Mahmoud_9893@hotmail.com

HUMAN EXPLORATION OF VENUS: A COMPARATIVE STUDY OF CREWED MISSIONS TO
MARS AND VENUS

Abstract

Venus seems to have been almost forgotten by the human space exploration community, which currently focuses only on Mars and the Moon. The Venusian atmosphere and planetary environment pose more challenges than Mars' or the Moon's, and manned missions to the planet are hardly ever considered. Not only Venus is the closest planet to Earth, but it also presents compelling opportunities for scientific studies on greenhouse effect and climate dynamics [1], as well as and surface processes and geophysics [2]. Therefore, a human mission to Venus would have immense scientific returns and direct impact on understanding our planet's atmospheric evolution in the upcoming years. This paper provides a comparative study of a crewed mission to Venus compared to proposed concepts of Mars missions. The study also intends to find common elements in the mission architectures and the spacecraft systems, as well as: comparing the feasibility of both missions with current technology; identifying technical challenges; energy systems both solar integrated and solar independent has been considered along with advancements in materials for longer sustainability for surface sample return and exploration has been considered. The feasibility of permanent settlements is also analyzed, comparing available resources from both planets, the complexity of the different architectures, and the scientific and economic interest of the settlements. The aim of this study is to present the space exploration community a new perspective on the benefits of missions to Venus and find common ground with current human exploration plans and add to the discussion on the priorities for human exploration.

References: [1] Probing the Interior Structure of Venus, Report by: Keck Institute for Space Studies (KISS) Venus Seismology Study Team, April 1, 2015. [2] Hall, J. L., et al. "Venus flagship mission study: Report of the Venus science and technology definition team." National Aeronautics and Space Administration, Jet Propulsion Laboratory, California Institute of Technology, Task Order NM0710851 (2009).