21st IAA SYMPOSIUM ON HUMAN EXPLORATION OF THE SOLAR SYSTEM (A5)
Human Exploration of Mars (2)

Author: Mr. Aman Arora
University of Petroleum and Energy Studies, India

Mr. Vipul Mani
University of Petroleum and Energy Studies, India
Mr. Aman Singhal
University of Petroleum and Energy Studies, India

DESIGNING A SELF-SUSTAINABLE HABITAT CAPABLE OF SUPPORTING LIFE ON MARS.

Abstract

As quoted by Neil Armstrong "The important achievement of Apollo was demonstrating that humanity is not forever chained to this planet and our visions go rather further than that and our opportunities are unlimited."

The need for expansion of mankind is more than ever. There are millions of questions to be answered. Do we have a survival plan? The answer is No, we don't but whatever maybe the case, moving further out in the solar system might be a good idea, if mankind is able to survive the next 5.5 billion years when sun expands enough to fry the earth.

This project investigates the challenges posed to the human survival on mars and involves designing a self-sustainable habitat capable of supporting astronauts for centuries to come.

This would be explained in part 3 of the Fernweh Project.

The project would be covered in 3 parts:

1) Selecting a suitable location:

The atmosphere of mars is very thin as a result of which the meteorites do not fully burn up, impacting the surface and also there is not enough shielding from the harmful solar radiation reaching the martian surface. Caves, canyons, lava tubes will prove to be a useful landing site as they would provide shielding from both the meteorites impact and the intense solar radiation. They might also offer access to minerals, gases, and ices helpful in the survival of astronauts. The project would potentially look for places suitable for the mission.

2) Forming a 3D Printed Habitat using martian regolith:

This project would involve designing a suitable habitat structure consisting of life support system using AutoCAD Revit. The Simulations would be done using COMSOL taking real martian variables into consideration. Further, designing a 3D printer capable of autonomously building a habitat using the resources available in the mars surface. The habitat would be capable of providing shielding from radiation, maintaining the pressure inside the chamber and suitable environment for astronauts.

3) Life Support System:

This project would involve designing a life support system capable of supporting the astronauts. This would comprise of radiation shielding methods , Pressure management equipment , temperature control, waste management, growing food, generating oxygen using electrolysis of martian ice, seperating CO2 from argon present in martian atmosphere etc. These simulations would be done in ANSYS and other softwares capable of providing real time simulations.