A Nuanced Thermal Analysis of a proposed Living Space on Mars. Pranav Sanghavi[1], Ashutosh Jadeja[2], Manu Manish Jaiswal[2] and Sat Ghosh[2,3] , [1]School of Electrical Engineering, VIT University, Vellore, India, [2]School of Mechanical and Building Sciences, VIT University, Vellore, India, [3]School of Earth and Environment, University of Leeds, Leeds, United Kingdom.

Geo-engineering explorations are not limited to planet earth alone as computational science advances, architects have joined mechanical engineers to find technological solutions reaching the loftiest frontiers of exploration-India is poised to play a very substantive role in the years to come. With the remarkable success of India's Mangalyaan Mission (the payloads on board the Mangalyaan are hurtling through space in its prefigured orbits), young Indian Engineers are already looking at manned missions on the Red Planet-in particular, they are looking at innovative and inexpensive solutions that are robust and achievable. The Mangalyaan Mission itself bears testimony that Indian Rocket Launches cost a fifth of NASA and ESA launches with comparable payloads and technical finesse. The Mars mission has impacted the Indian industry profoundly- Giant Infra-structure related Companies like Godrej and Boyce, and Larsen and Toubro which built many vital components for the Indian launch, intend to use this high-tech expertise coupled with India's advanced CFD personnel to take up extra-planetary design projects.

The aim of this paper is to showcase the power of computational modelling interfaced with Architectural Designing towards a sustainable housing project on the Martian surface. This paper, starts with planetWRF simulations – a state of the art planetary weather forecasting model - yeilding simulations over the proposed regions for future human habitation. The regions of interest are slated to be around the Aeria plains and Arabia plains near the Martian Equator. This is a first off-line simulation of WRF-planet and yields the wind flow patterns, solar insolation, the temperature and pressure over the chosen sites. The building form (cuboidal with a curved roof) is chosen, with carefully positioned skylights to optimize on solar gains. Most importantly, many sensitivity tests with the building fabric that will have the optimal U value (thermal transmittivity), draping the shell will be presented-the most obvious choice would be using basalt fibres (harvested from the basalt bedrock) along with other man made fabrics(including insulating aerogels) of varying thickness. The customized ANSYS simulations show the most desirable orientation with the prescribed form and shell fabric.This analysis thus reveals clearly demarcated active and passive zones for energy optimization purposes.

This unique combination of planetary meteorology and eco-architecture is exciting and do-able by India's young engineering talent pool-The average age of India's 2,500 strong Mars team is 27.