CAN ASTEROIDS BE USED TO MAKE MARS HABITABLE? E. J. Clacey
International Space University, 1 rue Jean-Dominique Cassini, 67400 Illkirch-Graffenstaden (Strasbourg), France. E-mail: erik.clacey@masters.isunet.edu

Introduction: Undertaking an immense project such as changing a planet in order to sustain human life on the surface, i.e. terraforming, will require vast resources and effort. This paper shall discuss how impacting asteroids onto the surface of a planet, such as Mars, can greatly assist the terraforming effort. It will discuss issues of selecting an asteroid, how to move it to a Mars impact trajectory as well as the useful effects it will have on the planet.

Discussion: In order to terraform Mars, it has been suggested to use asteroids [1, 2] to import critical elements that are lacking in the regolith. Nitrogen, associated with many life processes, is one such element. This could be mined from the atmosphere of several planetary moons, such as Titan, or could be imported using nitrogen-rich asteroids. Using current data, however, the amount of nitrogen available in asteroids, such as P-type icy asteroids, appears to be limited. Thus, there may be a need for future searches for nitrogen-rich asteroids, possibly in the Kuiper belt and beyond. Using one large (>>10 km diameter) impact to import all the elements that are needed is not deemed practical as it would severely delay any terraforming efforts and negate any terraforming initiatives done prior to the impact. In order to allow humans to live on the surface during the impacts, it would be necessary to limit the size of the asteroid to a few kilometers in diameter. Using a small asteroid, however, the desired change to the planet will be minimal. Another option could, therefore, be to target an asteroid onto the southern pole of Mars [2]. Impacting it at the pole would benefit terraforming by covering the region with a dark regolith mat, thereby reducing the surface albedo and increasing the melting of the pole. The melt would mainly consist of CO₂, which will outgas to the atmosphere and increase the mean surface temperature. Melted water may seep down cracks in the ice, taking heat with them, thus increasing the overall heating effect.

References: