

Transferring Near Earth Objects (NEOs) into a spacecraft for manned interplanetary exploration

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How will human can go beyond Mars to explore Jovian system and finally to reach to the Saturnian moon Titan, to search for life, on which several critical issues of manned interplanetary mission such as ECLSS supporting capability, food and water acquisition, propellant refuel, etc.?

Near Earth Objects or NEOs are comets or asteroids which have potential orbital intersection and closely approach to Earth. Despite many precursor researches have concluded that Near Earth Objects can be future resources of raw materials for building interplanetary spacecraft, this paper indicates utilizing Near Earth Objects itself would a possible transportation vehicle with habitat for manned interplanetary mission due to its plenty in amount and abundant resources (e.g. water ice, rare metals, etc.). Advantages of this proposal are: (a) To procure water by mining ice on NEOs surface or interior for human life support and ECLSS management.; (b) To obtain sufficient Hydrogen and any other possible substances for propellant needs; (c) The paper especially focus on designing of a habitat space by using regolith for an expedition crew (4 to 6 persons) on which NEOs provide efficient surface area to do so. Also, using regolith may provide a solution for cutting cosmic ray causing harmful result to human body while during interplanetary flight.

Candidate model is particularly to pick up an object from a branch of NEOs: Potential Hazardous Objects, known as their Minimum Orbit Intersection Distance (MOID) less than 0.05 AU, shorter period and relatively easily recognized by its high absolute magnitude. Although these celestial bodies have certain possibility to collide to Earth, we are currently monitoring and tracking their positions to ensure they will not come too close for sever damage. This technology may be helpful to locate suitable objects to meet our goal.

Mission profile is considered: (a) Sending a core module with a crew of 4 to rendezvous with PHOs target; (b) Mining and surface modification will be an on-site process, meanwhile, to produce propellant fuel and necessary material for plants to grow (e.g. food) and potable water; (c) During its flyby to Earth, new modules and crew are launched to rendezvous with the asteroid to extend habitat space; (d) To alter its orbit into Hohmann Transfer Orbit to proceed interplanetary flight course. Detailed sequence of asteroids selection and habitat design is included in full paper.

In this paper, reveals that transferring NEOs (near Earth comets or asteroids) into manned interplanetary exploration vehicle would be much reasonable not only is an alternative solution for avoiding designing massive space ship, carrying enormous amount of supplies (i.e. water, food) is unnecessary and cost reducible, but also it opens up a new possibility to procure asteroid resources for human space exploration purpose. This proposal is based on in-situ (in situation) methodology from technology readiness level of space architecture development progress.

In summary, although this research also points out issues that remain to be discussed in near future, it helps to establish further strategies to shape and to achieve certain goals on multidisciplinary efforts.

Keywords: NEOs, Asteroid mining, Human interplanetary exploration, ECLSS, Space settlements