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Author: Prof. Mariel Borowitz
Georgia Institute of Technology, United States

Mr. Jonathan Battat
Massachusetts Institute of Technology (MIT), United States

MULTIDISCIPLINARY EVALUATION OF NEXT STEPS FOR HUMAN SPACE EXPLORATION: TECHNICAL AND STRATEGIC ANALYSIS OF OPTIONS

Abstract

Across all stakeholders, there is a growing consensus that the long-term objective of global human space exploration is the long duration presence of people on the Martian surface. However, the key question concerns the choice of near-term missions that will bridge current human spaceflight activities in low Earth orbit and eventual Mars exploration. This paper contributes to this debate by identifying the scope of possible near-term missions, arguing that there are only four realistic proposals for initial human exploration beyond low Earth orbit: a cis-Lunar habitat, asteroid redirect, Mars flyby, and a short Lunar surface sortie. The paper then evaluates these missions across five criteria: 1) technical/economic feasibility, 2) contribution to the eventual goal of Mars, 3) potential for international cooperation, 4) global readiness for the mission, and 5) political feasibility to establish a clear assessment of the pros and cons of each of these four missions. While recognizing that any one of these missions represents a feasible option for future human space exploration, we recommend that the international community pursue development of a cis-Lunar habitat as its immediate goal. This mission maximizes development of technology necessary for Mars exploration, provides significant opportunities for meaningful international participation, and could be achieved on a reasonable schedule with current budgets. Both the asteroid redirect mission and Lunar exploration plans have the potential to benefit from the development of a cis-Lunar habitat, and could be retained as intermediate or parallel missions, as resources allow.