

IAF SPACE EXPLORATION SYMPOSIUM (A3)
Space Exploration Overview (1)

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A SYSTEMS APPROACH: THE ROLE OF THE GLOBAL SPACE ECOSYSTEM AND SPACE
RESOURCES IN ENSURING THE SUCCESS OF CREWED MISSIONS TO MARS**Abstract**

Together with the support of government agencies, private industry is leading the way for a crewed mission to Mars. The success of any such future mission(s) is largely dependent on the mobilisation and use of the global space ecosystem and space resource utilisation. The purpose of this paper is to use a systems approach in order to identify how the global space ecosystem and space resources contribute to the success of any such mission(s), and thus how they can be used most effectively and efficiently in order to ensure the highest likelihood of mission(s) success.

This paper initially presents and compares the known plans and timelines for crewed missions to Mars, before investigating the existing global space ecosystem, and space resource utilisation before exploring the expected developments in these areas over the coming years, and how developments in one may impact the other. Following this, a systems approach is used to identify the interconnections between the global space ecosystem, space resources, and crewed missions to Mars. From this analysis, key areas of contribution to the mission(s) from the global space ecosystem and space resource use are identified. Furthermore, potentially problematic mission aspects, the success of which could be increased and thus risk decreased through the better integration and use of the global space ecosystem and space resource utilisation are identified. The systems approach ultimately highlights key areas for better integration of the global space ecosystem and space resource utilisation to better increase the success of crewed Mars missions, providing technical and policy suggestions.

Using the results of the systems approach, a scenario analysis is undertaken whereby the future of crewed Mars missions is assessed for different levels of use and integration of the global space ecosystem and space resource utilisation. Ultimately this presents a clear pathway and methodology for engineers, scientists, and policy makers to follow, and check progress against, to ensure that the success of future crewed missions to Mars is as high as possible, with minimal risk, and effective use and deployment of funding and resources.