

Mars Exploration (3)
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CONCEPTUAL DESIGN OF A MARS SERVICING CONSTELLATION USING SMALL SATELLITES

Abstract

In this unprecedented time for Martian exploration, with missions from the USA, China, UAE and Europe all launching towards the red planet this year, it is evident, that Mars will continue to remain the focus of interest for many years to come. Current technological developments and long-term spaceflight programmes, such as Artemis supporting future missions to send astronauts to Mars, show a clear tendency that space exploration is evolving from purely robotic to human exploration. Based on the perceived demand, this paper investigates the need for future satellite constellations around Mars to provide an infrastructure for future Mars servicing missions. It foresees that providing complete and continuous coverage around Mars will prove beneficial in supporting future human and robotic operations. Different applications are discussed including communication and positioning systems, remote sensing, space traffic management and space weather monitoring. With a focus on small satellite technology, the feasibility and practicality of developing Mars constellations that are dedicated Mars servicing missions is assessed in a conceptual design study. Based on the assumed demand, a constellation providing global positioning and communication services around Mars with a decreased reliance upon data received from Earth has been chosen as a case study. This paper covers the technical results of the study, including trade-offs for mission architecture, constellation configuration, transfer strategy, mission analysis optimisation.