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## RAPID CREWED MISSIONS TO MARS WITH IMPULSIVE THRUST

**Abstract**

In this work, the feasibility of rapid crewed Missions to Mars was assessed for the case of impulsive thrust maneuvers, with a total crewed mission duration ranging from a few weeks to a few months. Foreseeable propulsion technologies could enable much faster return missions, cutting the travel time considerably and avoiding the long wait on Mars required by near minimum-energy transfers. This minimizes the long exposure to radiation and reduced gravity, extra life support consumables, and other difficulties presented by the traditional solutions. In order to determine the impact of several choices in the overall mass, required elements for each mission architecture were identified and its mass estimated taking as reference NASA's Design Reference Architecture 5.0. Representative propulsion systems were selected, for actual and for future systems, and missions based on impulsive maneuvers were defined and analyzed. To evaluate the results, Pareto fronts of mass versus mission duration were plotted. Since mass and time are proxies for cost and risk, rapid trips have lower risks but higher costs. The relatively simple approach adopted allows the identification of a set of possible improvements or challenges requiring further analysis. Namely the impact of in situ resource utilization or the use of aerocapture to minimize braking maneuvers, since the energies involved in fast missions change the problem considerably.