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PROJECT DREXCIYA: A PROPOSAL FOR A SPACECRAFT TO ASSESS MINING TECHNIQUES AT A NEAR EARTH ASTEROID

Abstract

In this report a mission proposal for asteroid exploration and prospecting is developed at the Pre-Phase A and Phase A level. The mission consists of a single spacecraft, known as Drexciya 1, which will be launched in 2027/2028 aboard SpaceX's Falcon Heavy launch vehicle. The spacecraft will then travel to, rendezvous with, orbit, and land on the metallic near-Earth asteroid 1986 DA, where it will identify concentrations of platinum group metals and test several mining and minerals processing techniques for use in future missions. The spacecraft's propulsion, AOCS, instrumentation, communications, power, thermal and structural subsystems are detailed, with a majority of the chosen components having prior flight experience. The novel technology required for mineral mining and processing is outlined with estimated mass and development cost information included. The total cost of developing and producing Drexciya-1 is estimated at 205−391 million USD, with additional Drexciya spacecraft estimated at 145−238 million USD. The report concludes that the mission proposal thus far is viable, including the development of all necessary technologies. To complete Phase A, a development schedule and more detailed costing information is required, especially with regards to the mining and processing technologies discussed. Much of the uncertainty surrounding these technologies stems from a lack of knowledge of the structural integrity and metal fraction of the asteroid. This knowledge will be improved significantly by the upcoming AMC Asteroid Prospecting Satellite 1 mission in 2023.